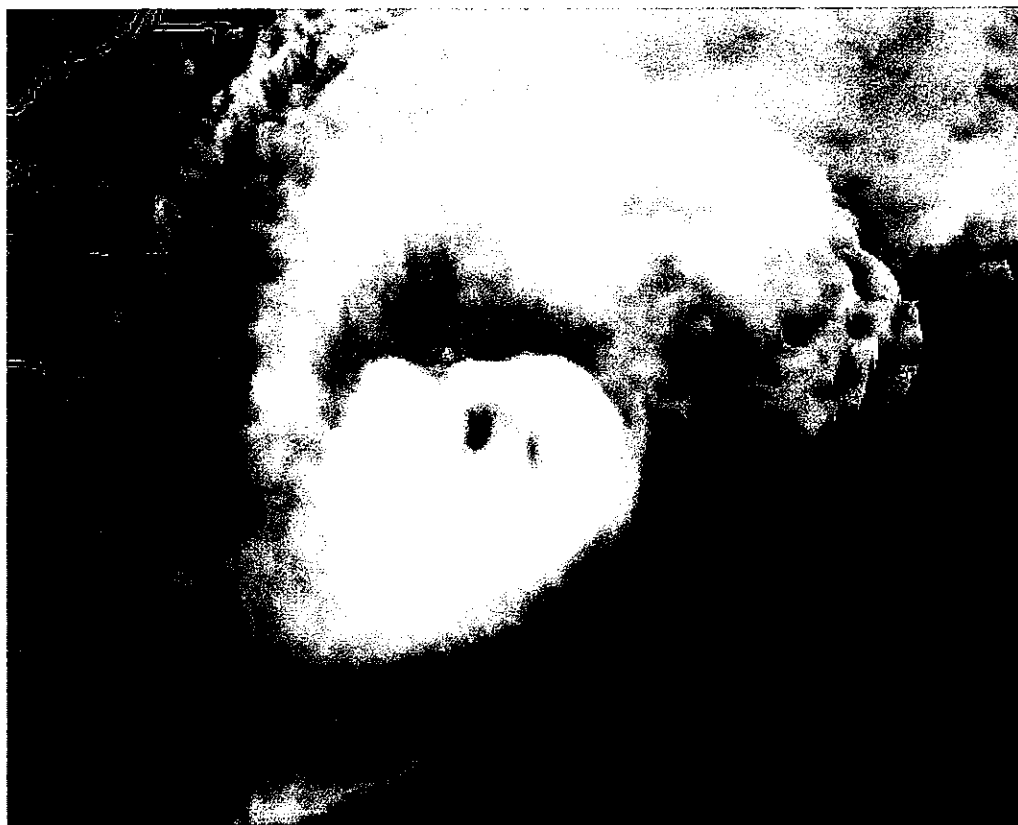


Appendix L



TOWN OF SOUTHERN SHORES

Hazard Mitigation Plan



Adopted February 15, 2005
Revised September 23, 2008


Technical Assistance Provided By:
NC Department of Commerce
Division of Community Assistance

James T. Fain III, Secretary
Gloria Nance-Sims, Director, Division of Community Assistance
Ruth J. Leggett, Chief Planner, Northeast Regional Office

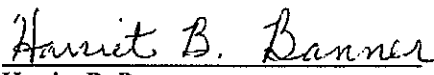
Adopted this 28th day of October 2009

SEAL





Mayor Raymond P. Sturza II



Harriet B. Banner
Deputy Town Clerk

Lee Padrick, Project Planner
Terria Baynor, GIS Support
Southern Shores Hazard Mitigation Plan

*Adopted by the Southern Shores Town Council
February 15, 2005
Revised September 23, 2008*

On November 4, 2009, the Southern Shores Town Council voted unanimously to adopt a resolution Requesting that Southern Shores updated plan be included with the Dare County Hazard Mitigation Plan. A copy of the resolution is attached.

Southern Shores Town Council

Don Smith, Mayor
Brian McDonald, Mayor Pro Tem
Jodi Hess
Jim Pfizenmeyer
Kevin Stroud

Southern Shores Hazard Mitigation Planning Committee

Alvin Rountree, Chairman
Dan Shields
Jim Pfizenmeyer
Kevin Stroud
George Kowalski
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David Kole
Karl Daniels
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Southern Shores Staff

Charles Read, Town Manager
Alvin Rountree, Code Enforcement Administrator
David Cowan, Code Enforcement Officer
Pat Forrester, CRS Coordinator / Permit Officer

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Executive Summary

This document is the Town of Southern Shores' Hazard Mitigation Plan. It has been prepared to meet the requirements of the federal government's Stafford Act as amended by the Federal Disaster Mitigation Act of 2000 (FDMA2K) and North Carolina Senate Bill 300. The Disaster Mitigation Act of required local governments to have a FEMA-approved and locally adopted hazard mitigation plan in place by November 1, 2004 in order to be eligible for federal disaster funds.

The mission of the Southern Shores Hazard Mitigation Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss prevention, and identifying activities to guide the town towards building a safer, more sustainable community.

Goals and Actions

The plan contains both goals and actions. The plan *goals* describe the overall direction that Southern Shores can take to minimize the impacts of natural hazards. The goals give board direction. The *action items* are a listing of activities in which the town and the citizens can be engaged to reduce risk.

Implementation

Implementation of the activities recommended by this plan will be monitored so the deadlines will be met. The Code Enforcement Administrator will be responsible for tracking the activities outlined in this plan. Each person assigned a responsibility in this plan will report to the Code Enforcement Administrator by the last day of each quarter (March 31, June 30, September 30, December 31). The Code Enforcement Administrator will report to the Town Council twice each year, on the first week and last week of hurricane season (June 1st and November 30th). The report should review progress and recommend changes as needed.

In addition, the Hazard Mitigation Planning Committee will reconvene during the first week of June each year to receive a presentation on the progress of the plan. The Hazard Mitigation Planning Committee will prepare an annual evaluation report that will be submitted to the Town Council.

Section 1: Introduction

The state of North Carolina faces extreme consequences from natural hazards, especially those of hurricanes and flooding. Between 1989 and 2007, there were 20 federally declared disasters. Damages from Hurricane Floyd in 1999 reached \$3.5 billion and Hurricane Isabel in 2003 reached \$3.37 billion. With Hurricane Floyd, 4,117 uninsured and under-insured homes were destroyed. The State's vulnerability to hurricanes and flooding make it crucial that communities and property owners have accurate, up-to-date information about all the risks of damage from flooding and high winds.

This document is the Town of Southern Shores' Hazard Mitigation Plan. It has been prepared to meet the requirements of the federal government's Stafford Act as amended by the Federal Disaster Mitigation Act of 2000 (DMA2K). North Carolina Senate Bill 300 requires local hazard mitigation plans to be in compliance with federal legislation. Senate Bill 300, passed by the NC Legislature in the summer of 2001, required local governments to have an approved and locally adopted hazard mitigation plan in place by August 1, 2002 in order to be eligible for state disaster funds to remedy disasters that occur after August 1, 2002. Additionally, the Disaster Mitigation Act required local governments to have a FEMA-approved and locally adopted hazard mitigation plan in place by November 1, 2004 in order to be eligible for federal disaster funds.

This document identifies the Town's vulnerability to several natural hazards and sets goals to mitigate damage from these hazards. The planning process used for this plan is made up of three parts: the *Mission*, *Goals*, and *Action Items*.

Why Develop a Mitigation Plan?

Planning is one of the best ways to anticipate and mitigate the destructive impact of identified hazards. The objective of planning is to produce a program of activities that will best tackle the community's hazard problems and meet other community needs. A well-prepared plan will guide a community's regulatory, educational and infrastructure efforts so that they are implemented more economically and in ways more attuned to the needs and objectives of the community and its residents. A well-prepared and executed plan should result in reduced losses. Risks not eliminated or mitigated through construction techniques have traditionally been offset through insurance (flood, wind and fire). However, the magnitude of losses faced by the insurance industry in recent years and resulting policy premium increases warrant reevaluation insured risk.

Originally, this document was prepared to qualify as a "Floodplain Management Plan" to be credited by Insurance Services Office (ISO) Community Rating System (CRS) program of the National Flood Insurance Program (NFIP). The NFIP provides federally supported flood insurance in communities that regulate development in their floodplains. The CRS reduces flood insurance premiums in those communities that do more than implement the minimum regulatory requirements. The Town of Southern Shores participates in the NFIP and is currently certified under the CRS as a Class 8 Community (effective 10/01/07). The Town has developed this plan in order to limit life and property losses due to a major flood and higher standards were not adopted for wind. Additional credit is provided if the activities are implemented based on a hazard mitigation plan that meets the criteria in Section 511 of the *CRS Coordinator's Manual*. The approach selected for preparing this plan was taken from Section 511 and some of this plan's section headings coincide with Section 511's headings.

Since then, there have been state and federal requirements placed on municipalities regarding hazard mitigation. This planning document strives to meet those requirements.

The mission of the Southern Shores Hazard Mitigation plan is *to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards*. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss prevention, and identifying activities to guide the town towards building a safer, more sustainable community.

Plan Methodology

Who Was Involved

The North Carolina Division of Community Assistance provided the Town with a professional planner to draft this plan for its initial adoption, with input from a planning committee, the Floodplain Management Plan Committee, established by the Town Council. This Floodplain Management Plan Committee has been renamed the Hazard Mitigation Planning Committee, for purposes of this plan. A number of the committee members are in positions to implement the majority of the plan's recommendations. The Committee membership for 2008 included:

- Alvin Rountree, Code Enforcement Administrator, Chairman
- Jim Pfizenmayer, Elected Official
- Kevin Stroud, Elected Official
- Charlie Read, Town Manager
- Bob Palombo, Planning Board Member
- Mike Florez, Planning Board Member
- Frans Koeleveld, Board of Adjustment Member
- David Kole, Police Chief
- Bob Harvey, Fire Chief
- Dan Shields, Southern Shores Civic Association
- Karl Daniels, Chicahauk Property Owners Association
- Richard Perkins, Real Estate
- Pat Forrester, CRS Coordinator
- Elizabeth Cubler, Construction

The planning process used for this plan is made up of three parts: the *Mission*, *Goals*, and *Action Items*. The *Mission* of the plan is a statement that articulates the reasons for Southern Shores to engage in hazard mitigation planning. The *Goals* describe the overall direction that Southern Shores can take to minimize the impact of natural hazards. The *Action Items* are a listing of activities in which the town and the citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation.

The Plan Committee was asked to develop these three parts of the plan. They used different techniques to develop the plan parts; including brainstorming and evaluating other planning documents such as the land use plan and floodplain management plan. Many of the goals and action items listed were adapted from the land use plan, the floodplain management plan, and the hazard mitigation plan.

CRS credit is based on a 10-step planning process. The 10 steps are:

- Step 1: Organize.
- Step 2: Involve the Public.
- Step 3: Coordinate with Agencies and Organizations.
- Step 4: Assess the Hazard.
- Step 5: Evaluate the Problem
- Step 6: Set Goals
- Step 7: Review Mitigation Strategies
- Step 8: Draft an Action Plan
- Step 9: Adopt the Plan
- Step 10: Implement, Evaluate, Revise

Each of these ten steps was included in the three part planning process: *Mission*, *Goals*, and *Action Items*.

Public Comments and Participation

The Committee held two committee meetings, on January 21, 2004 and March 10, 2004, during the preparation of the plan update. At the January 21, 2004 meeting, the Plan Committee reviewed the action plan from the town's floodplain management and hazard mitigation plans. At the March 10, 2004 meeting, the Plan Committee met immediately after the public input meeting, discussed ideas and comments collected at the public meeting, and recommended the plan be sent to the Planning Board and Town Council for consideration of approval. All Plan Committee meetings were open to the public.

Elements of the public participation plan included:

- Holding a public information meeting on March 10, 2004 at 9:00 a.m. to describe the planning process to interested citizens and listen to citizen suggestions and concerns;
- Copies of the Draft Hazard Mitigation Plan were made available at the Southern Shores Town Hall for public review on February 15, 2004; and
- On August 03, 2004, a public hearing was held on the amended Hazard Mitigation Plan. The Town Council of Southern Shores officially adopted the plan at that time. That meeting was advertised in the local newspaper (Coastland Times). No public comment received.

At the public information meeting, the public was given the opportunity to contribute ideas and concerns about hazard mitigation activities in Southern Shores. Some significant ideas were offered, and some action items were generated or changed to address these comments. A cross-section of the community attended the public information meetings, including residents, business leaders, and government agency officials.

In Spring 2003 the town distributed a hazard mitigation questionnaire to all property owners of record. The questionnaire was sent to 2,896 property owners and the Committee received 894 completed surveys, for a return rate of 31 percent. The questionnaire included a written comment and recommendation section.

Using the mailed survey, the public informational meeting, and the public hearing prior to adoption, citizens of Southern Shores were given ample opportunity to comment on the plan prior to adoption.

Southern Shores Hazard Mitigation Survey Results – 5/12/03

1. Are you a permanent or seasonal resident?						
Permanent – 54%		Seasonal – 44%		Don't Know – 2%		
2. What natural hazards threaten your property?						
Fire- 2%	Flood –4%	Wind – 19%	Don't Know – 2%	Wind/Fire – 29%	Wind /Flood – 43%	Flood / Fire – 1%
3. Which is the greatest threat?						
Fire – 11%		Flood – 13%		Wind – 71%	Wind / Flood – 2%	Don't Know – 21%
4. Has your property suffered damage from natural hazards in the past?						
Yes – 26%		No – 60%		Don't Know – 14%		
5. If YES, then what hazard(s)?						
Yes - 190		Wind – 81%	Flood – 11%	Wind/Fire – 4%	Wind / Flood – 2%	
6. Do you know where to find information on making your property more resistant to natural hazards?						
WIND	Yes – 44%	No – 50%	Don't Know – 6%			
FLOOD	Yes – 43%	No – 41%	Don't Know – 16%			
FIRE	Yes – 47%	No – 42%	Don't Know – 11%			
7. Do you have adequate insurance for each hazard?						
Yes – 80%		No – 4%		Don't Know – 16%		
8. Has your Homeowners Insurance or Flood Insurance premium increased recently?						
Yes – 63%		No – 18%		Don't Know – 19%		
9. If YES						
<10% - 14%		10-25% - 27%		26-50% - 14%		>50% - 5% Don't Know – 40%
10. Are you aware that local flood ordinances that exceed FEMA minimum standards contribute to the community's 20% discount on flood insurance policies?						
Yes – 35%		No – 40%		Don't Know – 25%		
11. Would you support similar ordinances for Fire and Wind if such discounts were available?						
Yes – 85%		No – 4%		Don't Know – 21%		
12. Are you aware that the Forest Service recommends 30 feet of lawn area surrounding your home to mitigate wildfire damage?						
Yes – 24%		No – 60%		Don't Know – 16%		
13. Would you like more information or have the Fire Inspector make an on-site assessment of your property?						
Yes – 28%		No – 72%				

Coordination With Other Agencies

There are two reasons to involve agencies and private organizations in planning efforts. First, they may be implementing or planning to implement activities that can affect flood damage or some of the other interests and concerns. The Committee wanted to make sure that their efforts were not going to be in conflict with a government program or duplicate the efforts of another organization. Second, the Committee wanted to involve other agencies to see if they could assist their efforts. Help may be in the form of flood hazard data, technical information on various measures, guidance on regulatory requirements, advice and assistance in the planning effort, implementation of a recommended measure, and financial assistance to help implement a recommended measure.

During the initial research period at the beginning of the planning process, the Committee members discussed various outside agencies to contact. The planning process included an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved. The parties invited include:

- US Army Corps of Engineers
- Dare County Emergency Management
- Dare County Floodplain Manager
- Dare County Management Information Specialist
- Town of Kitty Hawk
- Town of Kill Devil Hills
- Town of Nags Head
- Town of Duck
- Town of Manteo
- Soil and Water Conservation District
- NC Power
- Outer Banks Association of Realtors
- Outer Banks Homebuilders Association
- Association of Insurance Agents
- NC Division of Coastal Management
- Dare County Board of Education
- NC Division of Emergency Management
- Sprint
- Charter Communications
- Dare County Water System
- Build the Bridge Committee
- Outer Banks Chamber of Commerce
- Currituck County
- Regional Medical Center
- Outer Banks Hospital
- Dare County Sheriff
- NC Department of Transportation

These agencies were sent an e-mail notice of the public input meeting and were invited to attend.

In addition to coordination with outside agencies, the Town of Southern Shores reviewed existing plans, studies, reports, and technical information to assist in the preparation of this plan. These existing resources included:

- Southern Shores Land Use Plan
- Flood Insurance Study
- Flood Insurance Rate Maps
- Flood Damage Prevention Ordinance
- Southern Shores Floodplain Management Plan

- **Zoning Ordinance**

The Town has begun a two year process of updating its Land Use Plan in 2007. The Coastal Area Management Act planning guidelines require that the topic of hazard mitigation be addressed in the Land Use Plan. The Town will ensure that the hazard mitigation section of the Land Use Plan is complementary of the Hazard Mitigation Plan.

Additionally, Dare County and the municipalities received updated flood insurance rate maps effective 09/20/06. These maps included changes to base flood elevation in some parts of the town. This update of the Hazard Mitigation Plan will reflect the changes depicted on the new flood maps. The Flood Damage Prevention Ordinance was amended at the time of adoption of the new flood maps. The NC Division of Emergency Management promulgates a model ordinance for coastal communities, and this model was considered for adoption, with modifications, at the time of consideration for the new maps. Any conflicts between the Hazard Mitigation Plan and the amended Flood Damage Prevention Ordinance were addressed during this year's update of the plan.

The Southern Shores Floodplain Management Plan meets the requirements of the Community Rating System. Southern Shores originally was required to adopt a floodplain management plan because the Town had 10 or more repetitive loss properties. The majority of these repetitive loss properties were located in Martin's Point, a subdivision outside the Town's corporate limits and located in the extraterritorial jurisdiction. Since the adoption of the floodplain management plan, Martin's Point residential has been removed from the Town's extraterritorial jurisdiction and is regulated by Dare County's Flood Damage Prevention Ordinance. This document will serve as the floodplain management plan for Southern Shores and the Martin's Point commercial area.

The Zoning Ordinance contains a number of regulations that pertain to density within the Town. While not a tool used explicitly for hazard mitigation, the density limitations of the Zoning Ordinance control the land uses and types and numbers of structures within the Town, thereby limiting the number of structures that may be susceptible to natural hazards.

How Do I Use the Plan?

Each section of the mitigation plan provides information and resources to assist people in understanding the town and the hazard-related issues facing citizens, businesses, and the environment. Combined, the sections of the plan work together to create a document that guides the mission to reduce risk and prevent loss from future natural hazard events.

The structure of the plan enables people to use a section of interest to them. It also allows the town to review and update sections when new data becomes available. The ability to update individual sections of the mitigation plan places less of a financial burden on the town. Decision-makers can allocate funding and staff resources to selected pieces in need of review, thereby avoiding a full update, which can be costly and time-consuming. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to Southern Shores.

Section 2: Community Profile

Why Plan for Natural Hazards in Southern Shores?

Natural hazards impact citizens, visitors, property, the environment, and the economy of Southern Shores. Flooding, hurricanes, nor'easters, wildfire, thunderstorms, tornadoes, heat waves, and coastal erosion have exposed Southern Shores' residents and businesses to the financial and emotional costs of recovering after natural disasters. The risk associated with natural hazards increases as more people move to areas affected by natural hazards. The inevitability of natural hazards, and the growing population and activity within the town create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future natural hazard events. Identifying risks posed by natural hazards, and developing strategies to reduce the impact of a hazard event can assist in protecting life and property of citizens and communities. Local residents and businesses can work together with the town to create a natural hazards mitigation plan that addresses the potential impacts of hazard events.

Geography and the Environment

With a 2006 permanent population of 2620 (North Carolina State Demographics), Southern Shores is located on a barrier island off the coast of northeastern North Carolina. It is bounded on the east by the Atlantic Ocean, the south by NC 158 (North Croatan Highway) and on the west by Currituck Sound and Jean Guite Creek (Ginguite Bay).

The Town of Southern Shores was incorporated in 1979. The area encompassed by the town was a real estate development of the Kitty Hawk Land Company. The town is four miles long, north to south, and approximately one mile wide and has an area of 4.2 square miles. A Southern Shores Civic Association, initially established by the developer, was instrumental in obtaining the Town's municipal incorporation. The first Town Council, appointed after its incorporation by the legislature, drew its membership from the Civic Association.

Elevations in the town range from below sea level to 48 feet above mean sea level. There is high ground greater than 20 feet above mean sea level along a dune ridge that runs the length of the community and which serves to separate the maritime forest from the low-lying oceanside dune and swale area. The beach along the oceanfront is defined by the Coastal Area Management Act (CAMA) as an Ocean Erodible Area. This Area of Environmental Concern (AEC) extends from the first line of stable natural vegetation landward 60 times the long term erosion rate, which is 2 feet per year, plus 35 feet, or 155 feet. There is a setback for single family residences from the first line of stable vegetation of 60 feet. The minimum setback is 60 feet from the first line of stable vegetation for lots platted before 1979.

Demographic Profile

Southern Shores has a total population of 2,201, according to the US Census Bureau, 2000.

Table 1. Southern Shores Population Data (2000 Census)

Subject	Number	Percent
TOTAL POPULATION	2,201	100.0
Male	1,086	49.3
Female	1,115	50.7
Median Age (years)	51.4	
Under 5 years	101	4.6
18 years and over	1,791	81.4
Male	864	39.3
Female	927	42.1
65 years and over	547	24.9
Under 5 years	101	4.6
5 to 9 years	104	4.7
10 to 14 years	131	6.0
15 to 19 years	108	4.9
20 to 24 years	25	1.1
25 to 34 years	100	4.5
35 to 44 years	282	12.8
45 to 54 years	413	18.8
55 to 59 years	200	9.1
60 to 64 years	190	8.6
65 to 74 years	341	15.5
75 to 84 years	182	8.3
85 years and over	24	1.1
RACE	2,190	99.5
White	2,162	98.2
Black or African American	2	0.1

Subject	Number	Percent
Hispanic or Latino	34	1.5
American Indian and Alaska Native	5	0.2
Asian	5	0.2
Native Hawaiian / Pacific Islander	2	0.1
Some other race	14	0.6
Two or more races	11	0.5
SOCIAL CHARACTERISTICS		
Population 25 years and over	1,739	100.0
High school graduate or higher	281	96.7
Bachelor's degree or higher	527	48.9
Disability status (21 to 64 years)	161	13.0
Foreign Born	86	3.9
Now married (population 15 years and over)	1,375	73.6
Speak a language other than English at home	99	4.7
HOUSING CHARACTERISTICS		
Total housing units	1,921	100.0
Occupied housing units	946	49.2
Owner-occupied housing units	886	93.7
Renter-occupied housing units	60	6.3
Vacant housing units	975	50.8
YEAR STRUCTURE BUILT		
1999 to 2000	160	8.3
1995 to 1998	493	25.5
1990 to 1994	445	23.0
1980 to 1989	554	28.7
1970 to 1979	209	10.8
1960 to 1969	38	2.0
1940 to 1959	29	1.5
1939 or earlier	4	0.2

Source: US Census 2000 Summary File 1

Economic Profile

During the year 2001, 43.6% of the labor force was employed in management, professional and related occupations, with another 30.7% working in sales and office occupations. Another 11.5% were employed in service occupations.

Table 2. Southern Shores Workforce By Industry (2001)

Occupation	Number	Percent
Employed civilian population 16 years and older	922	100.0
Management, professional, and related	402	43.6
Service	106	11.5
Sales and office occupations	283	30.7
Farming, fishing, and forestry	4	0.4
Construction, extraction, and maintenance	92	10.0
Production, transportation, and material moving	35	3.8

Source: NC State Data Center

In 2000, the town's median household income was \$61,676. The median family income was \$68,250 and the per capita income was \$35,933.

There were 834 single-family owner-occupied homes. The median home value was \$221,500. Of these homes, 1,432 had a mortgage, and 346 did not.

Development Trends

Southern Shores, with an area of approximately 2,600 acres, is predominantly low-density, single-family dwellings. As a tourist and retirement community, there are three types of buildings, generally characterized as Permanent Resident, Investment/Rental, and Commercial. In 1984, the Zoning Ordinance changed minimum building lot size from 10,000 square feet (50' frontage) to 20,000 square feet (100' frontage), thus reducing the number of buildable lots to insure effective sewage treatment.

Homeowner Associations

There are two (2) principle associations (Southern Shores Civic Association (SSCA) and Chicahawk Property Owners Association (CPOA)) and several smaller associations. The Architectural Review Boards of these two associations contribute to the control of natural vegetation, dune protection, height and view restrictions, public access to beaches, and a higher general quality of construction.

Oceanfront raw property values of \$800,000 are typical. New homes built on these lots begin at \$250,000. Custom-built, luxurious five-bedroom homes with all amenities are economically feasible investments for out of state owners due to the continuing strong demand for rentals. The rental season spans 20 to 30 weeks per year. In-season rates for these homes can reach \$12,000 per week. The fact that these residences are usually custom designed homes contributes to more carefully detailed joints and closer controls during the construction process. Coastal and floodplain construction standards now require all oceanfront homes to be built on pilings. Wave loadings on pilings and breakaway walls for carports/storage require engineering design. However, grade beams as recommended in the Army Corps of Engineers' Coastal Construction Manual are not normally included in design. Cathedral ceilings in particular are a popular feature and require an engineer's certification for wind loads.

Due to the large number of people renting these homes during the prime hurricane season (June – November), the septic tank fields are stressed to capacity. Any saltwater flooding in these areas would pose sanitary problems. Low pressure systems are installed in Pelican Watch subdivision. This is the only oceanfront duplex complex in the Town, and has been completely built out with 24 units.

Sound and canal front development is characterized by water access structures such as piers and bulkheads. These are permitted by CAMA regulations.

There has been moderate commercial development in the town in recent years. All commercial development is located along North Croatan Highway (US 158). One private wastewater treatment facility serving residential units operates in Town.

Due to development pressures and the rising cost of land in Southern Shores, much of the future development will be in the form of redeveloping existing lots; smaller, older homes will be demolished making way for larger homes. The increase in size of new structures will place more people within the hazard areas, thereby making these properties and people more susceptible to hazard events.

State Regulations

Coastal Area Management Act (CAMA) – The Area of Environmental Concern (AEC) along the oceanfront is defined by CAMA as an ocean erodible area extending from the mean low water line landward 60 times the long term erosion rate, which is 2' per year, plus 35 feet or 155 feet. This translates to a setback for buildings from the first line of stable vegetation of 60'. CAMA regulations and the Coastal Resources Commission prohibit any form of beach hardening in the form of seawalls, bulkheads, riprap, groins, and the like along the oceanfront. A small section (100') of bulkhead and sandbags exist between the beach and several duplexes in Pelican Watch. The Town acknowledges the natural processes and dynamics of the ocean shoreline and manages growth accordingly. Improper development along the estuarine shoreline will pollute or destroy adjacent waters and wetlands. Estuarine shorelines are vulnerable to erosion and flooding. The State achieves the objective of soil conservation by permitting bulkheading and riprap along the estuarine shoreline. The Town manages this development through the building permit process. The Town uses its zoning ordinance building setbacks for sedimentation control.

Federal Regulations

The National Flood Insurance Act of 1968, Flood Disaster Protection Act of 1973, National Flood Insurance, and Mitigation and Erosion Management Act of 1991, and National Flood Insurance Reform Act of 1994 play pivotal roles in the Town's floodplain management. Any development work in a flood hazard area needs local permits prior to the work to ensure the work will not aggravate the effects of flooding and that structures are flood damage resistant. Elevation certificates are required for all new residences. All residences in Zone AE and VE must have the lowest horizontal member 2 feet above the base flood elevation.

Clean Water Act – U.S. Army Corps of Engineers defines "wetlands" and regulates development. All development in "wetlands" must meet local zoning. Local zoning limits the intensity and types of uses allowed. As the availability of land areas decreases, the Town can expect to see proposals for development over wetlands. All such development would have to be on pilings or fill permits issued and, while costly now, this situation may become more cost-effective as land becomes more limited and land prices increase.

Zoning

Building height limits in residential and commercial zones are 35' measured from the lowest Natural grade elevation or finished grade whichever is greater. Many builders have commented that the town's 2' freeboard requirement above the BFE for homes in the floodplain restricts the size of homes that can be built to one story in some cases. In this way the houses are being squeezed from the top and the bottom. Recommendations from studies conducted in cooperation with the Blue Sky program led to the adoption of the 35' height limit to accommodate a safer roof pitch. The Zoning Ordinance has been amended to include a Hurricane and Storm Reconstruction and Redevelopment and General Use Standards for Ocean Hazard Areas (September 3, 1991). The Land Use Plan for Southern Shores recommends no increase in commercial land uses within the Town's jurisdiction. The Town does not have any hotels or motels or a traditional commercial district. The Town seeks to provide services for the permanent population, rather than a transient population. The majority of the Town is RS-1, Single-Family Residential Zoning District. There is a 30 percent maximum allowable lot coverage; this coverage may be increased to 60 percent with on-site stormwater detention for commercial property only.

Wastewater Treatment

The Town has no municipal sewage collection or treatment facility. The Town relies on septic tank systems with gravity flow or low pressure systems. One on-site wastewater treatment plant has been constructed to serve a residential Planned Unit Development and adjacent commercial properties. Most soils in town are suitable for septic tank usage on lots of 20,000 square feet or greater. There is concern that flooded or malfunctioning septic systems can pollute groundwater or estuarine waters. The Town conducts periodic water quality testing. Homesites are effectively limited by lot coverage requirements and septic tank capacity.

Water Resources Access and Use

The Town's ocean, sound, and canal shorelines attract people to the community and provide the basic recreational and aesthetic amenities fundamental to Southern Shores. The SSCA owns and maintains many common areas throughout the town. Use of these facilities, such as the marina, soundside wading beach, and ocean access crossovers is enjoyed through membership in the Association. As growth continues in the town, the pressures placed upon the use and development of these shorelines may increase. The Town's role in managing and protecting these shoreline resources is by CAMA and the Zoning Ordinance. The Town has ~~two~~ CAMA Local Permit Officers. The NC Coastal Area Management Act has established Areas of Environmental Concern (AEC) for ocean and estuarine areas and regulations for each type of AEC.

Stormwater Runoff

The town, through its Zoning Ordinance, regulates the extent of impervious surface on lots at 30% coverage for residential and 60% coverage for commercial property. Attention is directed to prevent runoff problems from property before a building permit is issued through an on-site, predevelopment meeting and lot disturbance permit. Existing problem areas are being actively addressed and a mutual solution is being sought.

Stormwater Implementation

Figure 1. Base Map of Southern Shores

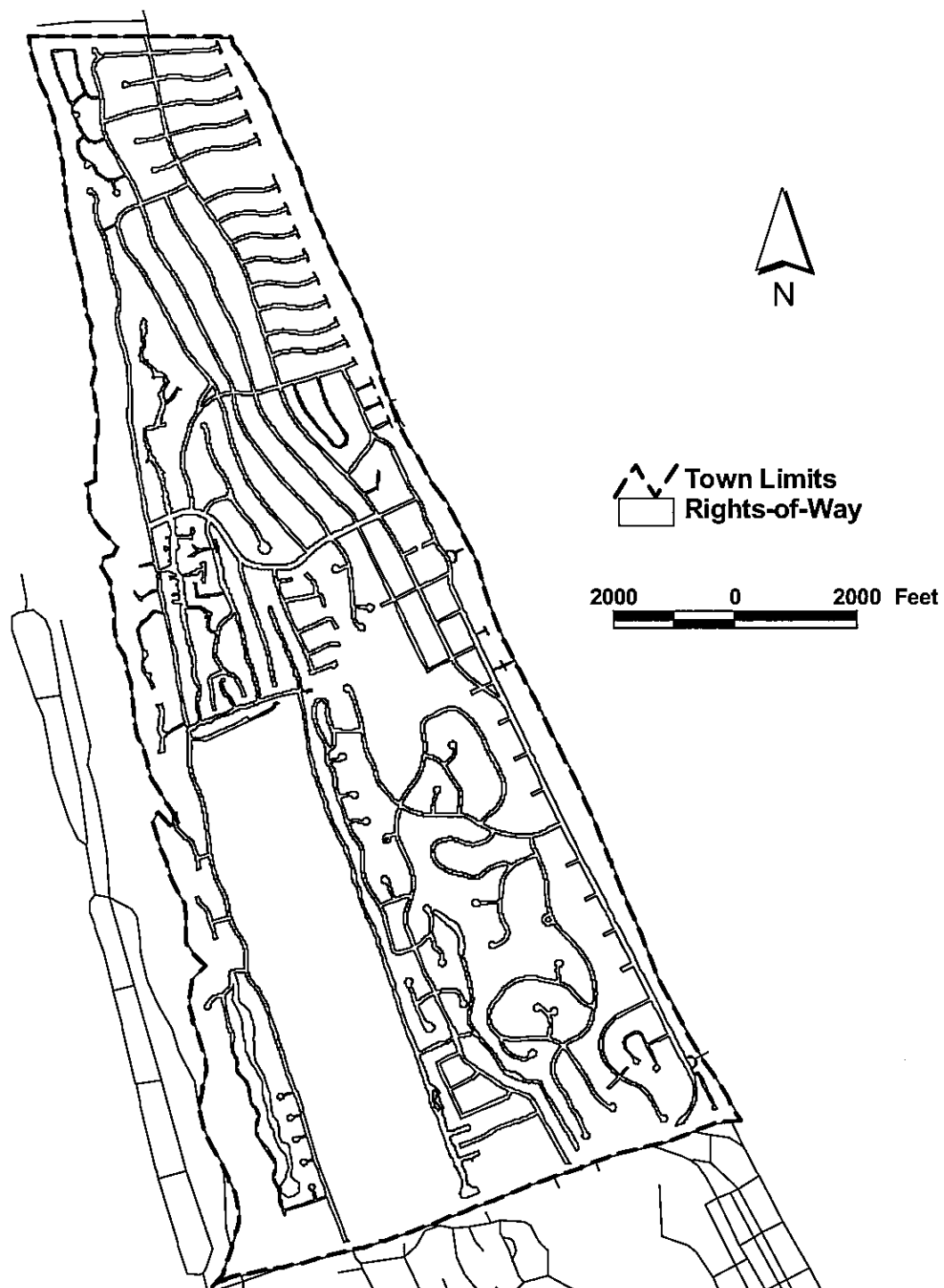


Figure 2. Existing Land Use and Flood Zones (F.I.R.M.)

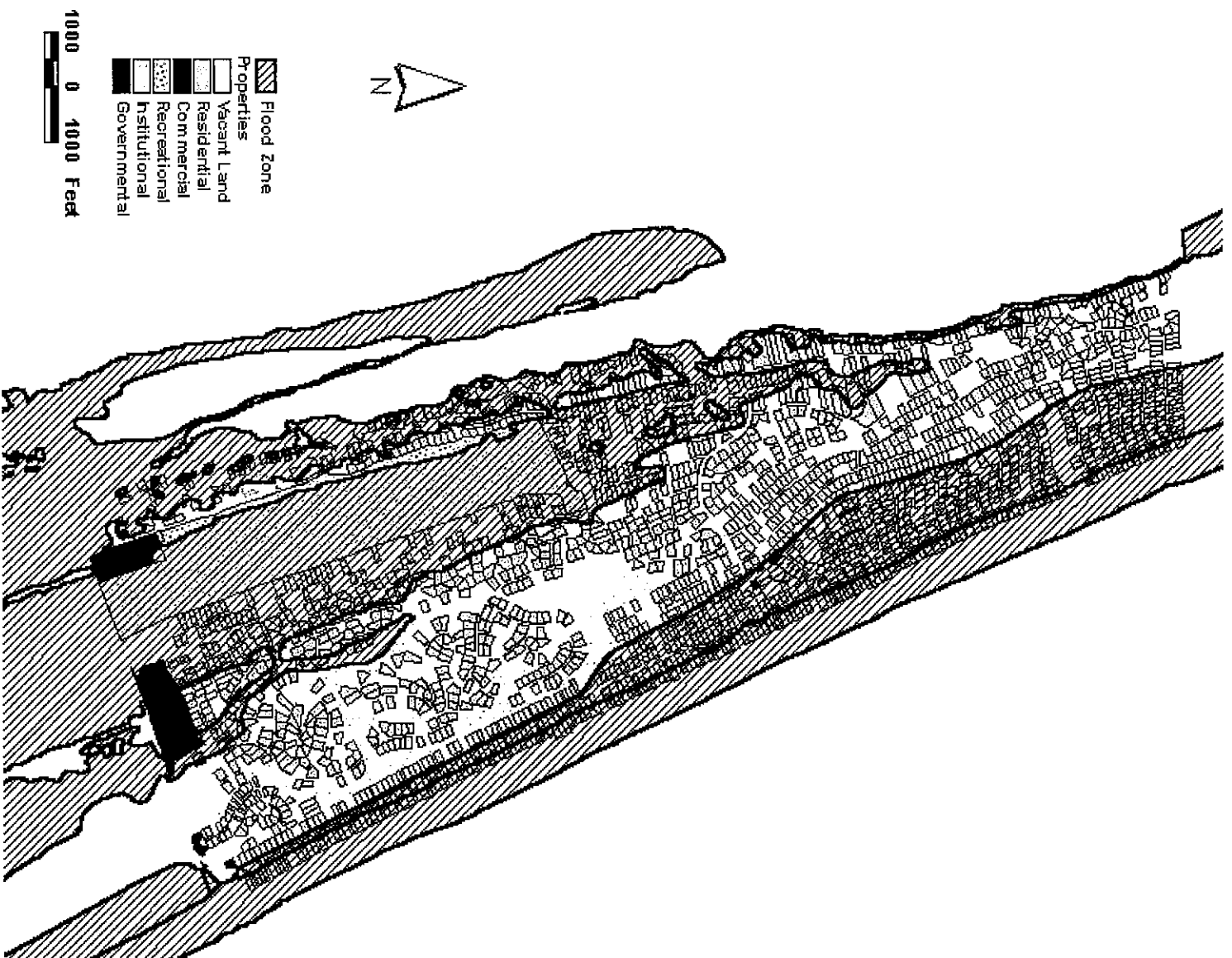


Figure 3. Existing Land Uses and Slow Moving Storm Inundation

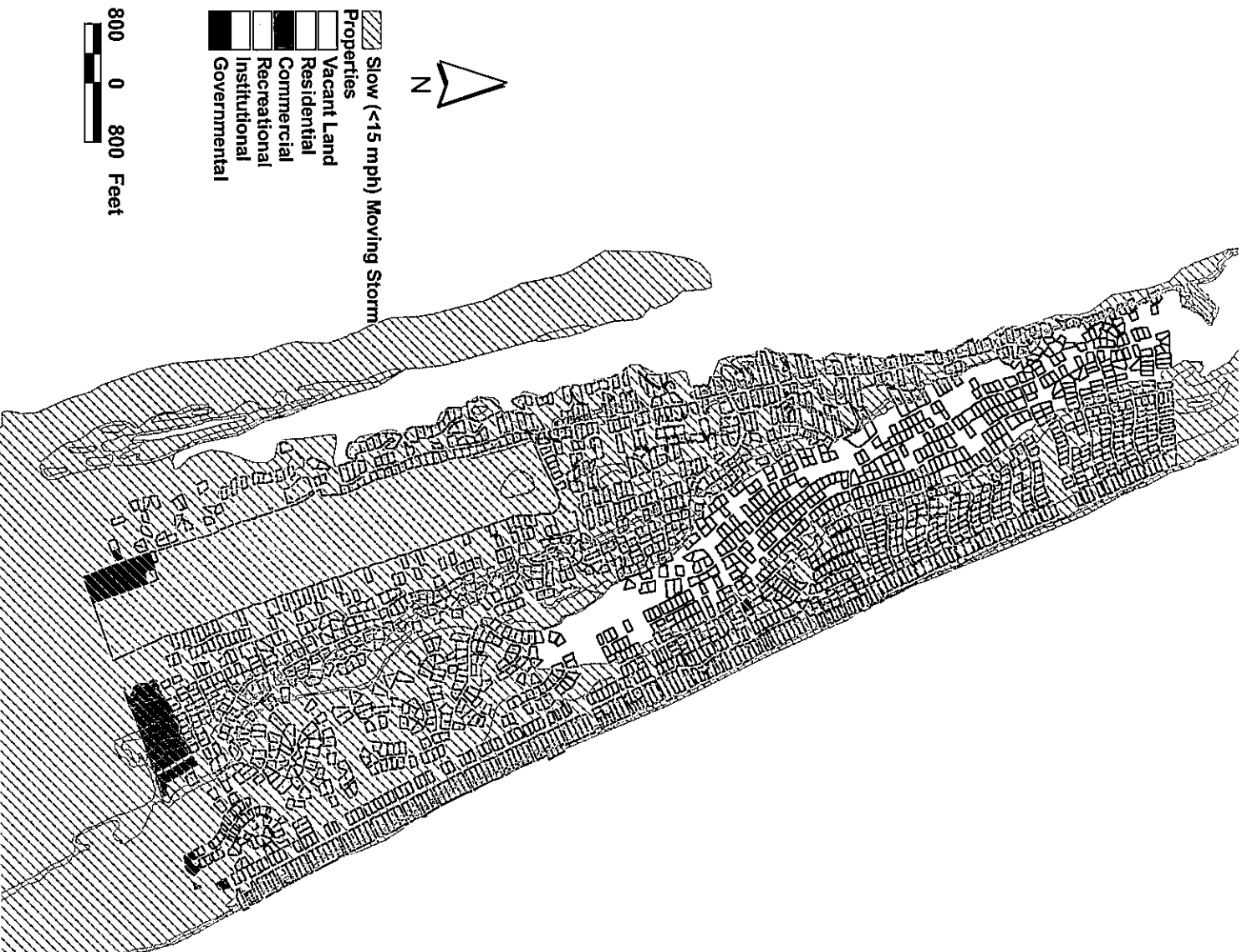


Figure 4. Existing Land Uses and Fast Moving Storm Inundation

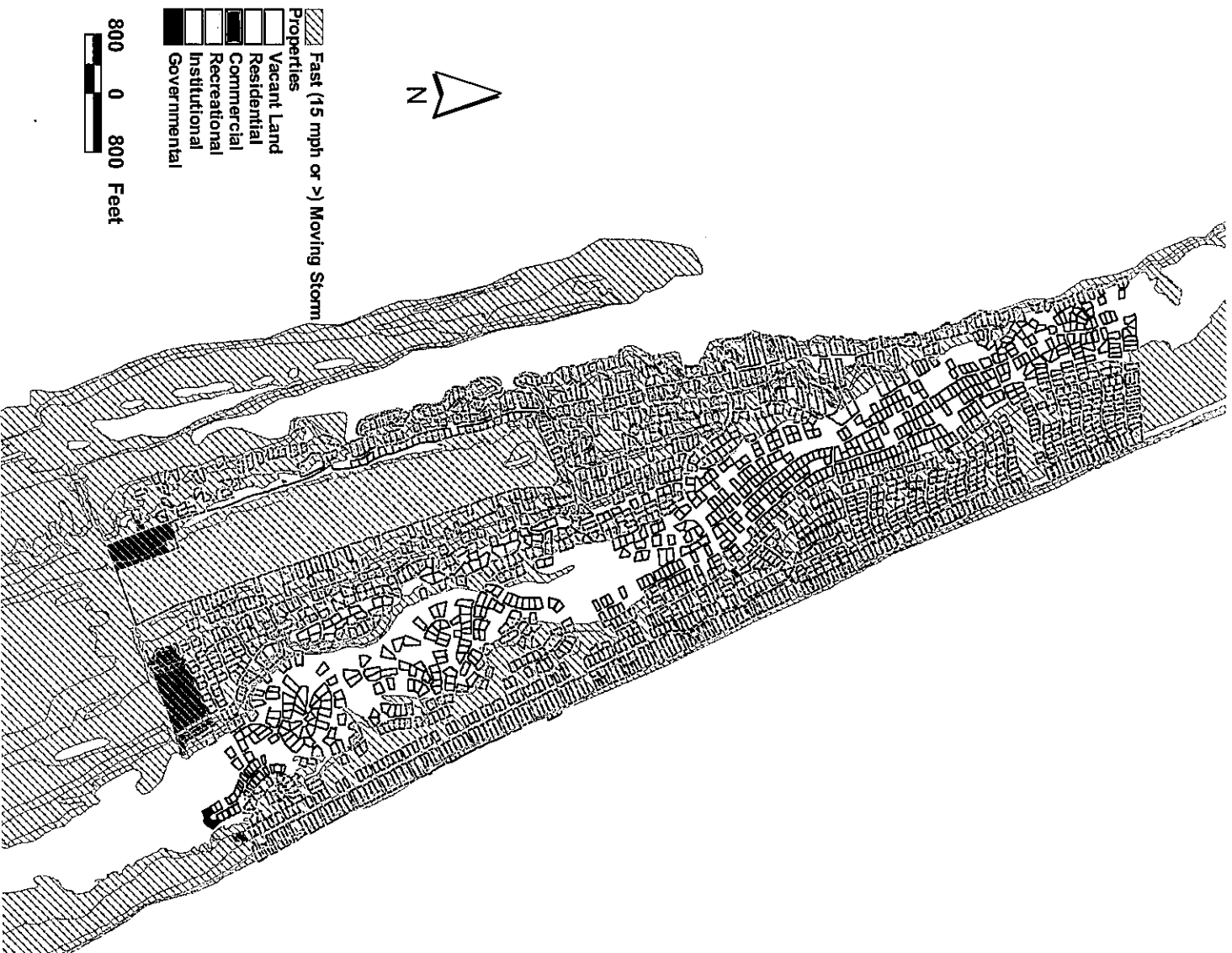
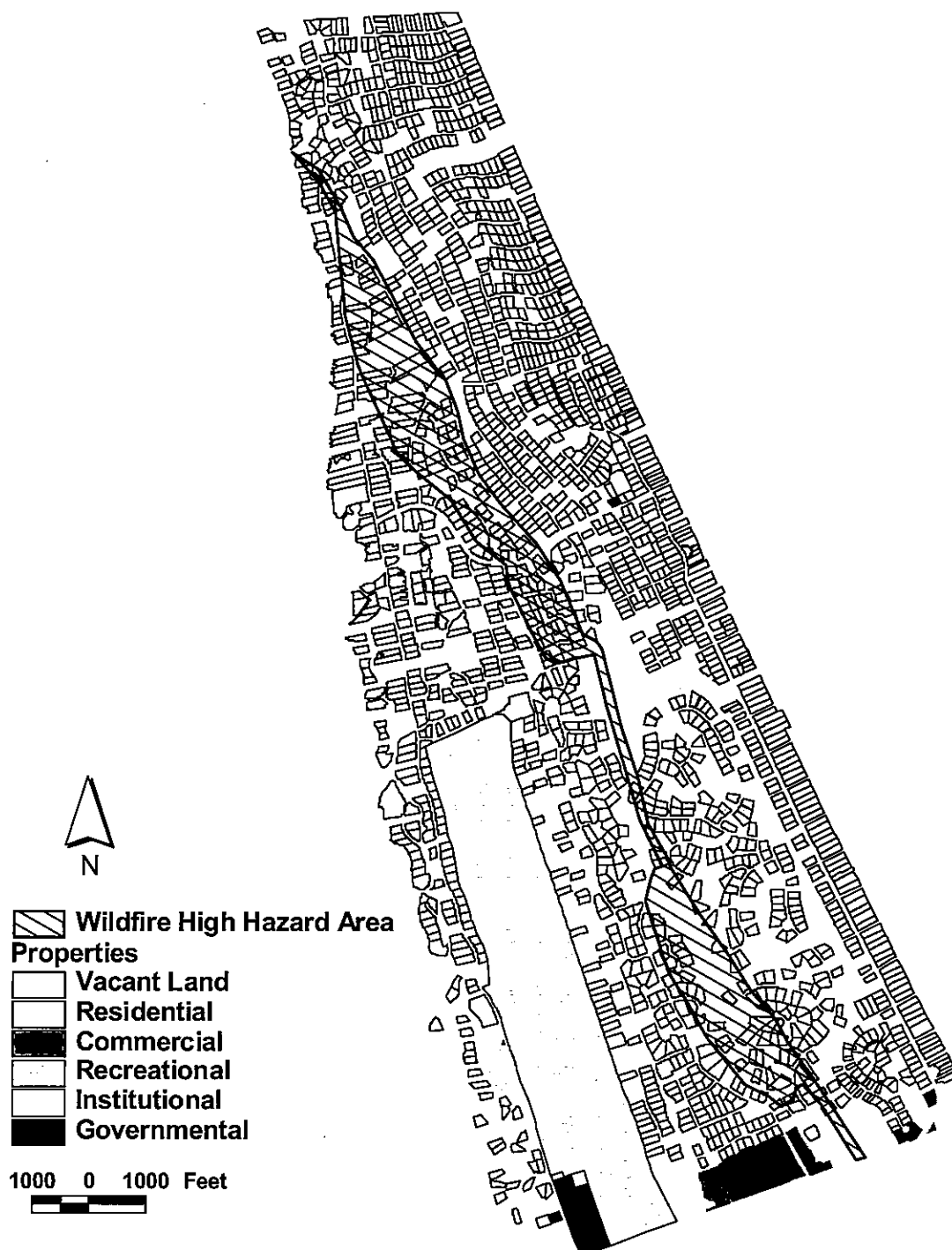


Figure 5. Existing Land Uses and Wildfire Hazard Areas



Section 3: Risk Assessment

What is a Risk Assessment?

Conducting a risk assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Specifically, the five levels of a risk assessment are as follows:

- 1 – **Hazard Identification** identifies the geographic extent and intensity of the hazard, the intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. Southern Shores identified several major hazards that consistently affect this geographic area. These hazards were identified through an extensive process that utilized input from the Hazard Mitigation Planning Committee, as well as recommendations from North Carolina Emergency Management.
- 2 – **Profiling Hazard Events** describes the causes and characteristics of each hazard, how it has affected Southern Shores in the past, and what part of Southern Shores' population, infrastructure, and environment has historically been vulnerable to each specific hazard. A profile of each hazard discussed in this plan is provided in each hazard section. For a full description of the history of hazard specific events, please see the appropriate hazard section. Previous hazard events have not been mapped, due to the relative small size of Southern Shores' jurisdiction.
- 3 – **Vulnerability Assessment/Inventorying Assets** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. Critical facilities are of particular concern because these entities provide essential products and services to the general public that are necessary to preserve the welfare and quality of life in the town and fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities have been identified and mapped.
- 4 – **Risk Analysis/Estimating Potential Losses** involves estimating the damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. Describing vulnerability in terms of dollar losses provides the community with a common framework to measure the effects of hazards on assets. For each hazard where data was available, quantitative estimates for potential losses are included in the hazard assessment.
- 5 – **Assessing Vulnerability/Analyzing Development Trends** provides a general description of land uses and development trends within the community so that mitigation options can be considered in land use planning and future land use decisions. Analyzing these trends can help in identifying potential problem areas and can serve as a guide for incorporating the goals and ideas contained in this mitigation plan into other community development plans.

***Note:** The information on the maps in this plan was derived from Dare County's GIS. Care was taken in the creation of these maps, but is provided "as is." Southern Shores cannot accept any responsibility for any errors, omissions or positional accuracy, and therefore, there are no warranties that accompany these products (the maps). Although information from land surveys may have been used in the creation of these products, in no way does this product represent or constitute a land survey. Users are cautioned to field verify information on this product before making any decisions.*

Hazard assessments are subject to the availability of hazard-specific data. Gathering data for a hazard assessment requires a commitment of resources on the part of participating organizations and agencies. Each hazard-specific section of the plan includes a section on hazard identification using data and information from local, county, state, or federal agency sources.

Southern Shores conducted a vulnerability assessment for the flood hazard using Geographic Information Systems (GIS) to identify the geographic extent of the hazard and assess the land use and value at risk from the flood hazard. Insufficient data exists to conduct vulnerability assessments and risk analyses for all the hazards listed and addressed in the plan.

Regardless of the data available for hazard assessments, there are numerous strategies the town can take to reduce risk. These strategies are described in the action items detailed in each hazard section of this plan. Mitigation strategies can further reduce disruption to critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure. Action items throughout the hazard sections provide recommendations to collect further data to map hazard locations and conduct hazard assessments.

Table 3. Federal Criteria for Risk Assessment

Section 322 Requirement	How is This Addressed?
Identifying Hazards	Each hazard section includes an inventory of the best available data sources that identify hazard areas. To the extent GIS data are available, the town developed maps identifying the location of the hazard in the town. The Risk Assessment sections of the plan include a list of the hazard maps.
Profiling Hazard Events	Each hazard section includes documentation of the history, and causes and characteristics of the hazard in the town.
Assessing Vulnerability: Identifying Assets	Where data is available, the vulnerability assessment for each hazard addressed in the mitigation plan includes an inventory of all publicly owned land within hazardous areas. Each hazard section also identifies potential mitigation strategies.
Assessing Vulnerability: Estimating Potential Losses	The Risk Assessment Section of this mitigation plan identifies key critical facilities and lifelines in the town and includes a map of these facilities. Vulnerability assessments have been completed for the hazards addressed in the plan, and quantitative estimates were made for each hazard where data was available.
Assessing Vulnerability: Analyzing Development Trends	The Southern Shores Community Profile Section of this plan provides a description of the development trends in the town, including the geography and environment, population, and land use and development.

Profiling Hazard Events

Southern Shores incorporated in 1979. In the history of the town, there have been few minor natural hazards that have directly impacted Southern Shores. However, several major hazards, such as hurricanes and nor'easters, have impacted Dare County as a whole, including Southern Shores. Detailed data concerning the history of hazard events is not available for Southern Shores. However, there is good data for hazard events at the county level.

Dare County has seen a significant number of hazard events over the past 50 years. The probability of future events is assumed to be the same as the past 50 years.

Table 4. Summary of Reported Storm-Related Damage and Casualties in Dare County prior to Hurricane Isabel.

Source: NOAA, National Climatic Data Center (Reports from National Weather Service in Categories)
 Period of Record: Storms (1/1993-7/1999, except 6-7/1993); Tornadoes (1/1950-12/1992); Wind and hail (1/1959-12/1992)

Hurricane, tropical storm, and winter storm damages are multi-county estimates and storm-specific

Events				*Property	*Crop	*Total
	Numbers	Deaths	Injuries	Damage	Damage	Damage
Dare						
Extreme Cold	1	0	0	\$0	\$385,064	\$385,064
Hail	19	0	0	\$0	\$0	\$0
Floods	3	0	0	\$0	\$0	\$0
Thunderstorm Wind	66	0	0	\$541,435	\$0	\$541,435
High Winds	4	0	0	\$36,585	\$0	\$36,585
Rip Currents	3	2	3	\$0	\$0	\$0
Waterspouts	12	0	1	\$106,745	\$0	\$106,745
Funnel Cloud	1	0	0	\$0	\$0	\$0
Tornado	29	1	19	\$9,934,283	\$0	\$9,934,283
Subtotal	138	4	23	\$10,619,047	\$385,064	\$11,004,111
Hurricanes, Tropical Storms & Winter Storms (multi-county events that affected Dare)						
Hurricanes	8	19	14	\$1,450,556,400	\$566,399,842	\$2,016,956,241
Tropical Storms	5	0	0	\$24,125,687	\$43,052,156	\$67,177,844
Winter Storms	4	0	0	\$25,438,518	\$0	\$25,438,518
Subtotal	17	19	14	\$1,500,120,605	\$609,451,998	\$2,109,572,603

*Damages are in 2004 US dollars, adjusted using the consumer price index (US Bureau of Labor Statistics, March 2002, USDL-02-222, <http://www.bls.gov/news.release/cpi.nr0.htm>)

Vulnerable Populations

Southern Shores does not contain any specified vulnerable populations, such as day care centers, assisted living facilities, or hospitals.

Critical Facilities and Infrastructure

Critical and essential facilities are those facilities that are vital to the continued delivery of key government services or that may significantly impact the public's ability to recover from the emergency. The following figure illustrates the critical facilities, essential facilities, public infrastructure, and emergency transportation routes within Southern Shores.

Figure 6. Critical Facilities and F.I.R.M. 1993 Flood Zones

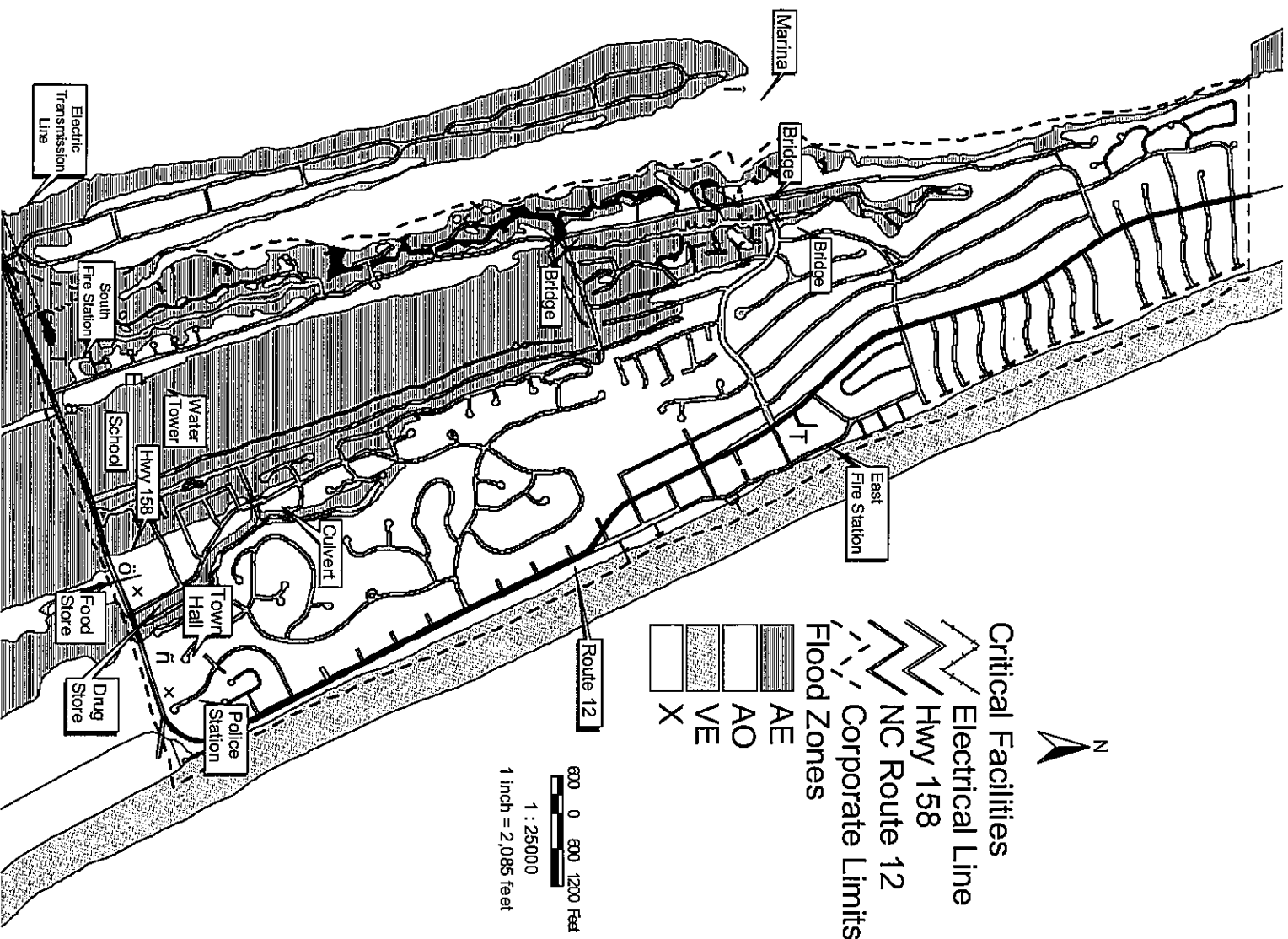


Figure 7. Critical Facilities and Slow (<15 mph) Moving Storm Surge Inundation

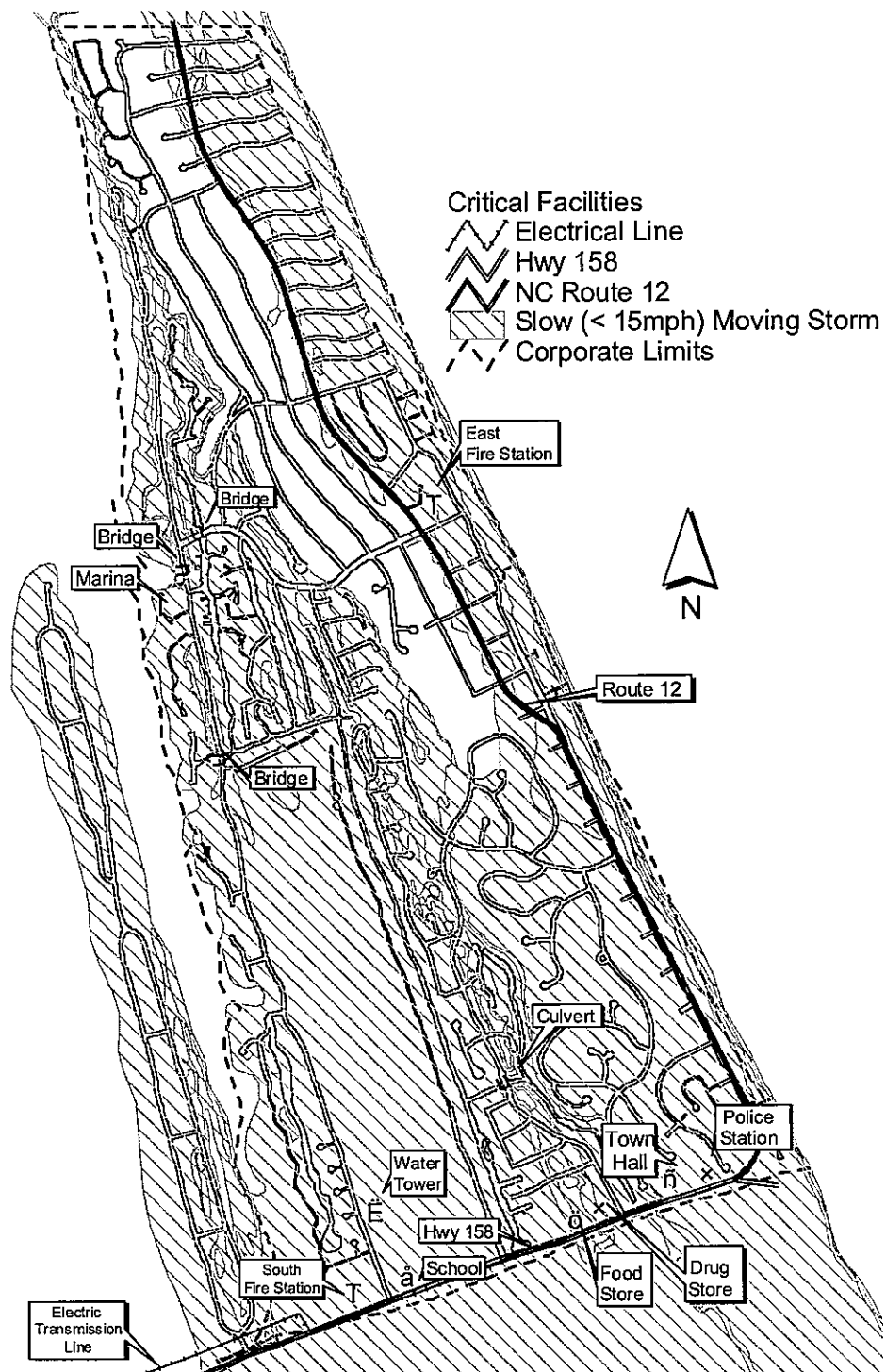


Figure 8. Critical Facilities and Fast (15 mph or >) Moving Storm Surge Inundation

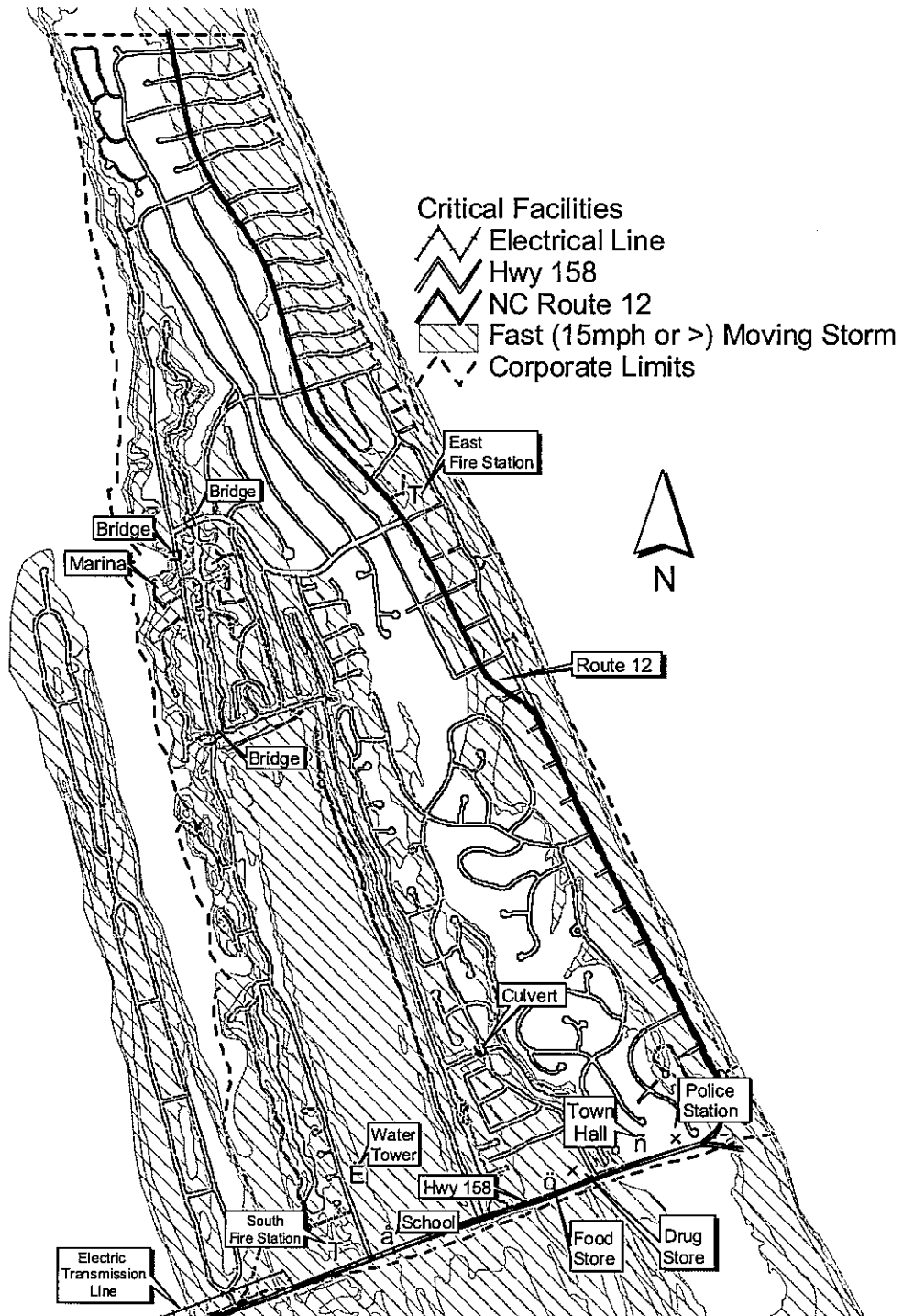
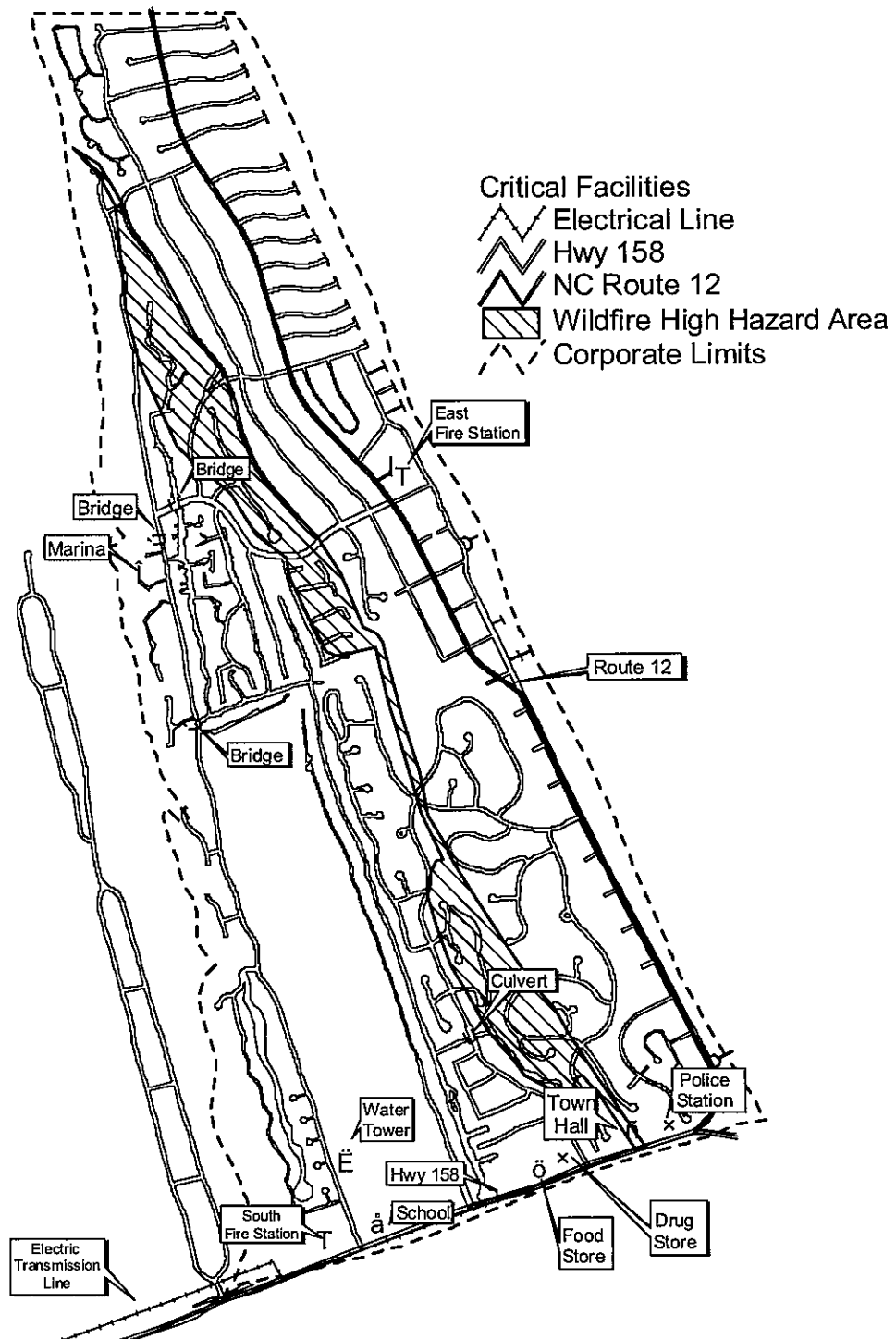


Figure 9. Critical Facilities and Wildfire High Hazard Areas



The East and South Fire Stations are located within flood hazard areas. However, at this time it is impractical to consider moving the stations.

Identifying Hazards

The Hazard Mitigation Plan Committee identified and analyzed each of the hazards by:

- 1- the *type* of natural hazards that threaten the community;
- 2- the *likelihood of occurrence* of the hazards;
- 3- the *locations* in the community that are most vulnerable;
- 4- the *impact* of the hazard; and
- 5- the strength of the hazard, scored by a *Hazard Index*.

The types of natural hazards that threaten the community are hurricanes, nor'easters, wildfires, thunderstorm/lightning, coastal erosion, tornadoes, heat waves/droughts, landslides/sinkholes, severe winter storms, and earthquakes/tsunamis.

The *likelihood of occurrence* estimates the likelihood of each type of hazard occurring in the Southern Shores area.

- Highly Likely = near 100% probability in the next year
- Likely = between 10% and 100% probability in the next year
- Possible = between 1% and 10% probability in the next year
- Unlikely = less than 1% probability in the next year

The *location* criterion measures whether the hazard covers a small, medium, or large proportion of the community.

The *impact* measure is a combination of the severity of the event, its magnitude, and the density of human activity in the affected area.

- Catastrophic = >50% magnitude, multiple deaths, complete shutdown of critical facilities for >30 days, >50% of property is severely damaged
- Critical = 25% to 50% magnitude, multiple severe injuries, complete shutdown of critical facilities for >14 days, >25% of property is severely damaged
- Limited = 10 % to 25% magnitude, some injuries, complete shutdown of critical facilities for >7 days, >10% of property is severely damaged
- Negligible = <10% magnitude, minor injuries, shutdown of critical facilities for <24 hours, <10% of property is severely damaged

The *hazard index* is a scoring system based on a 1 to 5 scale, with 5 being the highest possible score and 1 being the lowest. The score is obtained by how much impact and how frequently this hazard affects the community.

Table 5 represents the Hazard Identification and Analysis matrix and the corresponding Hazard Index scores.

<i>Hazard</i>	<i>Likelihood of Occurrence (ex. highly likely, likely, possible, unlikely)</i>	<i>Location (ex. small, medium, large)</i>	<i>Impacts (ex. catastrophic, critical, limited, negligible)</i>	<i>Hazard Index</i>
<i>Hurricane</i>	<i>Likely</i>	<i>Large</i>	<i>Limited</i>	<i>5</i>
<i>Nor'easter</i>	<i>Highly Likely</i>	<i>Large</i>	<i>Limited</i>	<i>5</i>
<i>Wildfire</i>	<i>Possible</i>	<i>Small</i>	<i>Limited</i>	<i>3</i>
<i>Thunderstorm / Lightning</i>	<i>Highly Likely</i>	<i>Medium</i>	<i>Negligible</i>	<i>3</i>
<i>Coastal Erosion</i>	<i>Highly Likely</i>	<i>Medium</i>	<i>Negligible</i>	<i>3</i>
<i>Tornado</i>	<i>Possible</i>	<i>Small</i>	<i>Limited</i>	<i>2</i>
<i>Heat Wave / Drought</i>	<i>Possible</i>	<i>Large</i>	<i>Negligible</i>	<i>2</i>
<i>Landslide / Sinkhole</i>	<i>Unlikely</i>	<i>Small</i>	<i>Negligible</i>	<i>1</i>
<i>Severe Winter Storm</i>	<i>Possible</i>	<i>Large</i>	<i>Negligible</i>	<i>1</i>
<i>Earthquake / Tsunami</i>	<i>Unlikely</i>	<i>Large</i>	<i>Catastrophic</i>	<i>1</i>

Table 5. Hazard Identification and Analysis

Risk Assessment Summary

The Hazard Index allowed the Hazard Mitigation Committee to prioritize the natural hazards in Southern Shores. Hurricanes and nor'easters were determined to be the major threat, mainly because of flooding concerns. Wildfire and thunderstorms/lightning constitute the other major natural hazard that affect the town. All natural hazards listed will be discussed, but emphasis on planning will focus on these high-ranking natural hazards.

Community Capability

The capability assessment evaluates Southern Shores' political willpower, institutional framework, technical know-how, and ability to pay for mitigation. The capability of all levels of government (local, state, federal, and regional), as well as the contributions made by non-governmental organizations (churches, charities, community relief funds, the Red Cross, hospitals, for profit and non-profit businesses) should be included, with a description of their utility to the local community in terms of hazard mitigation.

Legal Capability

Enabling legislation in North Carolina grants a wide array of powers to its cities, towns and counties. The capability section of the local hazard mitigation plan analyzes each of the powers available to local governments enumerated in the North Carolina General Statutes to identify which can be wielded to craft hazard mitigation measures at the local level, and also assess legislation that may impose limits on certain mitigation efforts.

The various legal tools available to the town are:

- General police power
- Building codes and building inspections
- Land use
- Zoning
- Floodway regulation
- Planning
- Subdivision regulations
- Acquisition
- Taxation
- Spending

Institutional Capability

Southern Shores is a chartered community with a local government comprised of a Mayor and Town Council. Key government agencies include:

- Town Manager
- Public Works
- Town Attorney
- Town Clerk
- Code Enforcement Officer/Planning
- Police
- Fire

Political Capability

The Southern Shores Mayor and Town Council support the concept of hazard mitigation and will promote the economic efficiency and social utility of the mitigation measures contained in this plan.

Fiscal Capability

While federal programs carry out the bulk of disaster relief programs that provide funds for mitigation, local governments are encouraged to open the search field as widely as possible, and include alternative funding sources to supplement the local hazard mitigation budget. For instance, local businesses and organizations will frequently support projects that benefit their customers or employees, or which constitute good public relations.

- Hazard Mitigation Grant Program (HMGP)
- Disaster Preparedness Improvement Grant (DPIG)
- Flood Mitigation Assistance Program (FMAP)
- Public Assistance Program (PA)
- Small Business Administration Disaster Assistance Program
- Community Development Block Grant (CDBG)

Technical Capability

If the concept of hazard mitigation is being introduced to a local community for the first time, or if a more experienced community wishes to upgrade its level of mitigation, technical know-how may be at a premium.

Section 4: Multi-Hazard Goals and Action Items

This section provides information on the process used to develop goals and action items that pertain to the natural hazards addressed in the mitigation plan. It also describes the framework that focuses the plan on developing successful mitigation strategies. The framework is made up of three parts: the *Mission*, *Goals*, and *Action Items*.

Mission

The mission of the Southern Shores Hazard Mitigation plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss prevention, and identifying activities to guide the town towards building a safer, more sustainable community.

Goals

The plan *goals* describe the overall direction that Southern Shores can take to minimize the impacts of natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations that are outlined in the action items.

The goals are broken down into Activity Areas. This plan includes seven areas of activities. These activities are: preventive, property protection, natural resource protection, reconstruction, life and safety, emergency services, and public information. Each activity area contains at least one goal.

Action Items

The *action items* are a listing of activities in which the town and the citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation.

The mitigation plan identifies action items developed through data collection and research, surveys, and the public participation process. Mitigation plan activities may be considered for funding through federal and state grant programs, and when other funds are made available. To help insure activity implementation, each

action item includes information on the timeline and the responsible party. Upon implementation, the responsible person(s) may look to partner organizations for resources and technical assistance.

- **Responsible Person.** The responsible person(s) is the person or entity that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Responsible person(s) may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs.
- **Deadline.** Each action item includes an estimate of the timeline for implementation.
- **Funding.** Each action item will include a possible source of funding. Implementation ideas may include grant programs or human resources.
- **Prioritization.** Each action item is prioritized. The selection criteria used to analyze and prioritize each action step are: 1) cost effective; 2) environmentally sound; and 3) technically feasible. If an action item meets all three criteria, it is given a **High** priority; if it meets two criteria, it is given a **Medium** priority; and if it meets one criterion, it is given a **Low** priority. There is an explicit emphasis on cost effectiveness, in light of its possible use in environmental reviews for HMGP, FMA, and other federal hazard mitigation projects.

Southern Shores Hazard Mitigation Plan

1. PREVENTIVE ACTIVITIES

GOAL: INCREASE FLOOD AWARENESS

The Town of Southern Shores has a number of preventive activities in place that affect floodplain management and will continue these activities. The Town has a Zoning Ordinance, a Flood Damage Prevention Ordinance, open space preservation, stormwater management, and conducts a drainage system maintenance program.

Action: Continue enforcement of the zoning ordinance as a hazard mitigation tool

Responsible Person: Code Enforcement

Deadline: ongoing

Funding: General operating budget

Prioritization: High

The Zoning Ordinance contains provisions for low density zoning. Approximately 98% of the oceanfront lots are zoned RS-1, low-density residential zoning. The ordinance also contains provisions for minimum lot coverage. The Town has restrictive development regulations that include building setback lines and a low density zoning area in the form of a golf course.

Action: Identify "at risk" X Zone properties for added emphasis on flood risks and notify the responsible agencies about discrepancies between floodplain maps (FIRM versus SLOSH).

Responsible Person: Code Enforcement Officer

Deadline: December 2004

Funding: General operating budget

Prioritization: High

In the southeast corner of the town's jurisdiction, there is an area that lies outside the 100-year floodplain, as established by the FIRM, but is predicted by the S.L.O.S.H. models to be inundated during Category 3 storm events. This action step proposes to pursue whether or not to add these properties to the locally adopted flood map and settle this discrepancy.

Action: Continue enforcement of the Flood Damage Prevention Ordinance

Responsible Person: Code Enforcement

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The Flood Damage Prevention Ordinance protects property to a level greater than the NFIP's minimum requirement. This ordinance requires 2 feet of freeboard above the base flood elevation shown on the FIRM in all zones. Additionally, the Flood Damage Prevention Ordinance requires property owners that wish to improve their property by greater than 50% of the current structure value must conform with the current flood damage regulations.

Action: Implement stormwater management regulations

Responsible Person: Planning Board

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The Town has reviewed the need for stormwater management regulations and will implement recommendations. Standing water after heavy rains presents a safety hazard.

GOAL: REDUCE THE TOWN'S VULNERABILITY TO WILDFIRES

Action: Continue the enforcement of the NC State Fire Prevention Code, referenced by the Town Fire Code

Responsible Person: Fire Official

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The North Carolina State Fire Prevention Code, as referenced by the Town Fire Code, requires vacant and improved property to be kept clear of combustible vegetative waste. Owners may be issued civil citations.

Action: Continue enforcing the Lot Disturbance provisions of the Zoning Ordinance

Responsible Person: Code Enforcement ~~Administrator~~ Officer

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

Originally established to require documentation of natural grade elevations prior to grading and filling, this item ensures that a site visit is made of all property prior to land clearing activities. Inspections staff reviews potential development impact to vegetation in Town right-of-way and possible stormwater runoff issues. Site plan vegetation removals are evaluated for wildfire potential.

Action: Continue the periodic controlled burns of marshland to reduce wildfire fuels

Responsible Person: Fire Chief

Deadline: Ongoing

Funding: General operating budget

Prioritization: Medium (environmentally sound and technically feasible).

The town periodically undertakes controlled burns of marshland, with technical assistance from the North Carolina Division of Forest Resources. These burns reduce the amount of wildfire fuels.

Action: Continue testing the fire hydrants once a year and recording data

Responsible Person: Fire Chief

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The yearly hydrant testing program insures that the fire department has the necessary resources to combat urban fires. Collecting and recording the data provides the town with the necessary information to deal with any potential problems and minimize their effects on fire fighting ability.

2. PROPERTY PROTECTION ACTIVITIES

GOAL: MINIMIZE AND MITIGATE POTENTIAL DAMAGES TO INDIVIDUAL PROPERTIES FROM NATURAL HAZARDS

Action: Continue implementation of the Waterway Ordinance

Responsible Person: Code Enforcement

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The Town Waterway Ordinance requires property owners to keep their banks clear of growth and debris. The North Carolina Department of Transportation routinely inspects and clears debris from the drainage system on State maintained roads such as Route 12 and US 158. The Town amended its solid waste and waterway ordinances to specifically prohibit dumping in the drainage system.

Action: Seek the maximum points available from the Community Rating System to keep flood insurance costs to the citizens as low as possible

Responsible Person: Code Enforcement

Deadline: Ongoing

Funding: General operating budget
Prioritization: Medium (environmentally sound and technically feasible)

The town will continue the current mitigation activities and seek the maximum points available from the Community Rating System for the prescribed activities. CRS Credit is given for the town's Zoning Ordinance, which contains low density zoning provisions, recognized under Activity 430 (Higher Regulatory Standards) and a Flood Damage Prevention Ordinance, also recognized under Activity 430 (Higher Regulatory Standards). Open space preservation is credited under Activity 430 (Open Space Preservation). The drainage system maintenance program is credited under Activity 540 (Drainage System Maintenance).

Action: Conduct the Canal Inspection and Debris Removal program twice a year

Responsible Person: Code Enforcement
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

Twice a year, the Town conducts a Canal Inspection and Debris Removal Program. This covers all navigable canals, lagoons, and inlets serving the community to ensure they are clear to drain flood waters. There are 19 such bodies of water that empty into the Currituck Sound and Ginguite Bay.

Action: Continue enforcement of the state building code, including wind load requirements

Responsible Person: Code Enforcement
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

The town presently enforces the state building code and associated wind load requirements for coastal areas.

Action: Provide property owners and developers with information regarding the construction of FEMA "Safe Rooms" from the effects of tornadoes and severe storms

Responsible Person: Code Enforcement
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

An increasing number of homeowners are building safe rooms to protect their families from the high winds of hurricanes, or because they are unsure whether they will be able to safely evacuate an area. However, homeowners in flood-prone or storm surge areas should evacuate to provide safety for themselves or their families when a hurricane threatens.

3. NATURAL RESOURCE PROTECTION

GOAL: INTEGRATE NATURAL RESOURCE PROTECTION POLICIES WITH PROPERTY PROTECTION MEASURES

Action: Continue enforcement of the Dune Protection Ordinance

Responsible Person: Code Enforcement
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

The Town has developed some regulatory standards for the special hazard areas of coastal dunes and beaches. The Town has designated dune and beach areas as open space. Town ordinance prohibits driving on sand dunes and requires construction of walkways over dunes. CAMA setback regulations prohibit buildings within 60 feet of the first line of stable natural vegetation.

Action: Coordinate wildfire prevention efforts with tree preservation policies

Responsible Person: Planning Board
Deadline: Ongoing
Funding: General operating budget
Prioritization: Low (technically sound)

The town has adopted tree preservation policies, which may be in conflict with efforts to prevent wildfire. These two conflicting policies need to be addressed together, and a single policy statement for the town should be developed.

Action: Continue enforcing Coastal Area Management Act (CAMA) regulations

Responsible Person: Code Enforcement
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

The Town of Southern Shores participates in the North Carolina Coastal Area Management Program and is claiming special hazard credit points for the following coastal erosion management activities:

- Mapping the erosion-prone area to developing erosion rates;
- Regulating new development to reduce the susceptibility of buildings to erosion damage;
- Maintaining data on shoreline erosion; and
- Maintaining programs, such as bluff stabilization and beach nourishment that affect the rate of erosion.

Action: Continue enforcing the state Erosion and Sedimentation Control regulations

Responsible Person: Code Enforcement Officer
Deadline: Ongoing
Funding: General operating budget
Prioritization: High

If a property owner disturbs more than 1 acre, they must submit an Erosion and Sedimentation Control plan. Erosion and sedimentation control is credited under Activity 430 (Higher Regulatory Standards).

4. RECONSTRUCTION

GOAL: ESTABLISH PLANS TO SUPPORT RECONSTRUCTION EFFORTS AFTER A NATURAL HAZARD

Action: Continue to have a standing Reconstruction Task Force

Responsible Person: Reconstruction Task Force

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

The town has a standing Reconstruction Task Force that is on call and ready to serve in a post-disaster environment. The Reconstruction Task Force relies heavily on the Southern Shores Master Emergency Plan, which establishes post-disaster mitigation policies and procedures.

Action: Develop guidelines for reconstruction efforts

Responsible Person: Reconstruction Task Force

Deadline: June 2005

Funding: General operating budget

Prioritization: Medium (environmentally sound and technically feasible)

A responsibility for the standing Reconstruction Task Force is to develop guidelines to expedite reconstruction efforts. A major portion of the guidelines may be already detailed in the Southern Shores Master Emergency Plan.

Action: Communicate with citizens about plans and the problems of providing services after a storm event

Responsible Person: Reconstruction Task Force

Deadline: Ongoing

Funding: General operating budget

Prioritization: Medium (cost effective and technically feasible)

The Reconstruction Task Force needs to consider public information activities that will communicate to citizens the procedures in place after storm events.

5. LIFE AND SAFETY

GOAL: IMPLEMENT ACTIVITIES THAT ASSIST IN PROTECTING LIVES FROM THE EFFECTS OF NATURAL HAZARDS

Action: Develop a better flood warning system

Responsible Person: Reconstruction Task Force

Deadline: July 2008

Funding: General operating budget

Prioritization: Low (technically feasible)

The town's primary flood threat recognition system is operated by the National Weather Service which issues National Hurricane Center tracking reports. The town has adopted, and participates in, the Dare County Hurricane Evacuation Plan which provides for emergency warning dissemination. The town also has the capability to produce GIS maps using SLOSH inundation maps to convert a forecast from the National Hurricane Center to a predicted area of inundation throughout the community. Other response efforts include preparedness training programs and disaster drills. Southern Shores Master Emergency Plan includes warning and coordinating with critical facilities.

Action: Continue to monitor NC Turnpike Authority plans for the Mid-Currituck Bridge to expedite evacuation

*Responsible Person: Town Council
Deadline: Ongoing
Funding: General operating budget
Prioritization: High*

The Transportation Improvement Program (TIP), published by the NC Department of Transportation, has the Mid-Currituck Bridge, from Coinjock to Corolla, scheduled for completion 2013.

6. EMERGENCY SERVICES

GOAL: COORDINATE EMERGENCY PLANS FROM IMPACTED SERVICES (I.E., WATER, TELEPHONE, ELECTRIC, FIRE, RESCUE, AND MEDICAL)

Action: Encourage food stores and pharmacies within the town to have alternative power supplies during and after storm events

*Responsible Person: Reconstruction Task Force
Deadline: Ongoing
Funding: General operating budget
Prioritization: Low (technically feasible)*

Many people in the community depend on the local grocery stores and pharmacies for sustenance and medical needs. The Reconstruction Task Force should work with these businesses to ensure that alternative power supplies are available so that these businesses may reopen in the event of a disaster.

Action: Continue to provide an Emergency Operations Center

*Responsible Person: Town Council
Deadline: Ongoing
Funding: General operating budget
Prioritization: High*

The town should maintain an Emergency Operations Center, in order to implement the Master Emergency Operations Plan.

Action: Keep emergency plans current and provide staff with continuing education opportunities

*Responsible Person: Town Council
Deadline: Ongoing
Funding: General operating budget
Prioritization: High*

Southern Shores participates regularly in regional meetings on emergency preparedness.

7. PUBLIC INFORMATION

GOAL: COMMUNICATE WITH CITIZENS ABOUT THE SUSCEPTIBILITY TO NATURAL HAZARDS AND THEIR EFFECTS

Action: Educate citizens on expected impacts of hazards on daily lives

Responsible Person: Code Enforcement

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

Southern Shores implements many public information activities. Among the activities implemented are floodplain mapping information, outreach projects, real estate disclosure, and a floodplain library.

Southern Shores provides assistance on flood protection analysis. The Building Inspector provides assistance by reviewing plans, making site visits before, as well as during, and after construction. A list of contractors that have built homes in Southern Shores is available.

Action: Continue current public information outreach efforts regarding flooding

Responsible Person: Code Enforcement Officer

Deadline: Ongoing

Funding: General operating budget

Prioritization: High

Each year, the Town mails a brochure to every property owner describing the flood hazard. A separate brochure is mailed to every resident in the SFHA advising them of the potential flood hazard, the availability of flood insurance and flood protection methods. A list of properties in the floodplain is submitted to FEMA annually.

The town maintains and publicizes documents related to flood insurance, flood protection, flood proofing structures, and floodplain management. The Town assists the Kill Devil Hills branch of the Dare County Library with floodplain materials. Documents prepared locally and keyed to local conditions are the Town's Flood Insurance Study and the photographic account by David Stick, *The Ash Wednesday Storm*.

Action: Continue e-mail and website services

Responsible Person: Executive Assistant

Deadline: Ongoing

Funding: General operating budget

Prioritization: Medium (cost effective and technically feasible)

The widespread availability of internet access has allowed the town to use online services to disseminate public information to citizens and property owners.

Section 5: Plan Maintenance

Dare County Hazard Mitigation Plan

The plan maintenance section of this document details the formal process that will ensure that the Southern Shores Hazard Mitigation Plan remains an active and relevant document.

Plan Maintenance Process

The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing a plan revision every five years. This section describes how the town will integrate public participation throughout the plan maintenance process.

Plan Adoption

The Town Council of Southern Shores will be responsible for adopting the Southern Shores Hazard Mitigation Plan. This governing body has the authority to promote sound public policy regarding natural hazards. Once the plan has been adopted, the Code Enforcement Officer will be responsible for submitting it to the State Hazard Mitigation Officer at the North Carolina Division of Emergency Management. NC Emergency Management will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, Southern Shores will remain eligible for Hazard Mitigation Grant Program funds.

Monitoring, Evaluating and Updating the Plan

Implementation of the activities recommended by this plan will be monitored so the deadlines will be met. Where possible, each activity should be monitored in terms of dollar value of its flood loss reduction benefits.

The Code Enforcement Administration will be responsible for the tracking the activities outlined in this plan. Each person assigned a responsibility in this plan shall report to the Code Enforcement Administration by the last day of each quarter (March 31, June 30, September 30, December 31). The Code Enforcement Administration will report to the Town Council twice each year, on the first week and last week of hurricane season (June 1st and November 30th). The report should review progress and recommend changes as needed.

In addition, the Hazard Mitigation Planning Committee will reconvene during the first week of June each year to receive a presentation on the progress of the plan. The Hazard Mitigation Planning Committee will prepare an annual evaluation report that will be submitted to the Town Council.

The criteria the Hazard Mitigation Planning Committee will use in evaluating the plan are:

- Do the goals and actions address current and expected conditions?
- Has the nature or magnitude of risks changed?
- Are the current resources appropriate for implementing the plan?
- Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did the agencies and other partners participate in the plan and planning process as proposed?

Implementation Through Existing Programs

Southern Shores will incorporate the requirements of this hazard mitigation plan into other local plans. During the planning process for new and updated local planning documents, such as a comprehensive plan, CAMA land use plan, capital improvement plan, or emergency management plan, to name a few examples, the

Code Enforcement Administration will provide a copy of the hazard mitigation plan to each respective advisory committee member. The Code Enforcement Administration will recommend the advisory committee members ensure that all goals and actions of new and updated local planning documents are consistent with the hazard mitigation plan and will not contribute to increased hazards in the jurisdiction.

Continued Public Involvement

Southern Shores is dedicated to involving the public directly in review and updates of the Hazard Mitigation Plan. Any amendment to the Hazard Mitigation Plan must be made by the Town Council. A public hearing will be required before any consideration of an amendment to the plan can be made. The Town's current outreach methods will be used to disseminate hazard mitigation information to citizens and property owners.

Section 6: Hurricanes and Nor'easters

The major threats faced by Southern Shores are hurricanes and coastal storms (nor'easters), in addition to flooding. The Federal Emergency Management Agency's (FEMA) 1987 and 1992 Flood Insurance Studies state that the dominant source of flooding in the Town of Southern Shores is storm surge generated in the Atlantic Ocean. The Town experiences hurricanes, tropical storms, and severe extratropical cyclones, commonly referred to as nor'easters. Unlike a hurricane that may pass over a coastal location in a fraction of a day, a nor'easter may blow from the same direction and over long distances for several days. Although nor'easters (winter storms) are more diffuse and less intense than hurricanes, they occur more frequently and cover larger areas and longer coastal reaches at one time.

These storms present three types of hazards: wind, storm surge, and rain. The following is a description of these three hazards:

- **High winds:** Storms with wind speed ranging from over 74 mph up to 155 + mph are classified as hurricanes. These winds can blow roofs off of buildings and destroy mobile homes. All evacuation activities must be completed prior to onshore winds reaching tropical storm status (40 mph). [Refer to Appendix B for the Dare County evacuation procedures]

A related problem is tornadoes spawned by hurricanes, which will develop fast, inflict tremendous destruction, and vanish as fast as they appeared.

- **Storm surge:** This is a great dome of water caused by winds and pressure differences in the air. Areas are flooded by water that can be up to 18 feet higher than normal sea levels. On the Outer Banks, the maximum storm surge is experienced north of where the hurricane's eye makes landfall. This surge, especially when coupled with the breaking waves, causes great destruction and accounts for most hurricane deaths.
- **Rainfall:** Six to twelve inches of rainfall generally accompanies a hurricane. This causes flooding of streets before and during the worst part of a hurricane and river flooding inland after the storm passes. Flooding can be aggravated where drainage ways are blocked by hurricane-blown debris.

Hurricanes

Hurricanes are tropical cyclones with winds that exceed 74 miles per hour (mph) and circulate counter-clockwise about their centers in the Northern Hemisphere (clockwise in the Southern Hemisphere). Hurricanes are formed from simple complexes of thunderstorms, commonly known as convection. However, these thunderstorms can only grow to hurricane strength with cooperation from both the ocean and the atmosphere. First, the ocean water itself must be warmer than 81 degrees Fahrenheit. The heat and moisture from this warm water is ultimately the source of energy for hurricanes. Hurricanes will weaken rapidly when they travel over land or colder ocean waters -- locations with insufficient heat and/or moisture.

Hurricane Categories (Saffir-Simpson scale)

Category 1: Winds 74-95 mph. Damage to shrubbery, trees, unanchored mobile homes, and some signs. Storm surge 5-7 feet above normal. Some damage to piers, exposed small craft, and low-lying buildings.

Category 2: Winds 96-110 mph. Some trees blown down. Major damage to mobile homes and signs. Some damage to building roofs and windows. Storm surge 8-10 feet. Considerable damage to piers, marinas, small craft, and low-lying buildings.

Category 3: Winds 111-130 mph. Large trees and many signs blown down. Mobile homes substantially damaged. Some structural damage to small buildings. Storm surge 11-12 feet. In addition to water damage, structures severely damaged by waves and floating debris.

Category 4: Winds 131-155 mph. All signs blown down. Mobile homes destroyed. Extensive damage to roofing, windows, and doors. Storm surge of 13-18 feet above normal water levels.

Category 5: Winds over 155 mph. Some complete building failures. Storm surge over 18 feet. Major damage to structures less than 15 feet above sea level within 500 yards of shore.

Figure 10. Hurricane

Probability of Future

Southern Shores has a 24 tropical storm or hurricane's nautical miles of the town's Figure 10. However, the 36 a few miles to the south of probability in any given passing within 60 nautical jurisdiction is 24-36 percent occurrence).

Hurricanes, when Shores, impact a Large jurisdiction.

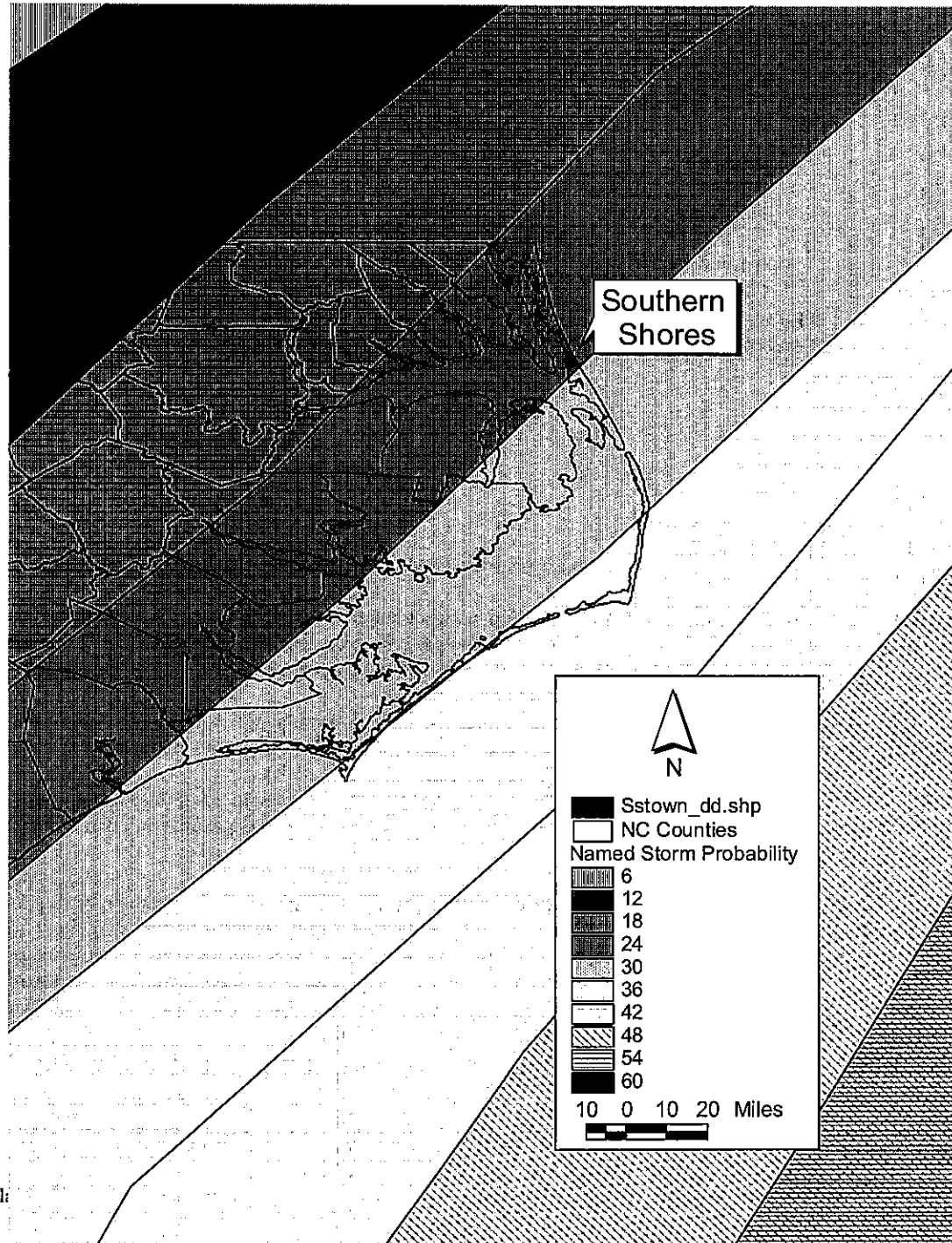
Impact of a hurricane on the

Since Southern Shores there have been a number of

Hurricane Emily, a grazed Hatteras Island on eye of the hurricane came Hatteras, but did not pass When the winds shifted northwest, water was forced Pamlico Sound, washing foundations south of measuring equipment to 107 miles per hour.

Hurricane Isabel, a Category north of Cape Lookout on Southern Shores fared well moved through the area. damage reported. However, up after the storm was

Dare County Hazard Mitigation Pl



Probability Map

Events

percent probability of a center passing within 60 jurisdiction, as shown on percent boundary is only the town. Therefore, the year of a named storm miles of the town's (Medium likelihood of

threatening Southern proportion of the town's

town would be Limited.

incorporated in 1979, hurricanes.

Category 3 hurricane, August 31, 1993. The within 20 miles of Cape over the Outer Banks. from the northeast to the onto the island from several homes from their Southern Shores. Wind recorded wind gusts of up

2 storm, made landfall September 16, 2003. as hurricane force winds There was no flood wind damage and clean estimated at \$1 million.

Neither of these storms caused significant structural damage in Southern Shores.

Nor'easters

Unlike a hurricane that may pass over a coastal location in less than a day, a nor'easter, or a severe extratropical cyclone, may blow from the same direction and over long distances for several days. Although nor'easters are more diffuse and less intense than hurricanes, they occur more frequently and cover larger areas and longer coastal reaches at one time. Nor'easters form near the Atlantic coast, generally over coastal areas where there is a large temperature gradient in wintertime between air over a cold landmass and air over relatively warm ocean waters. The presence of the Gulf Stream off the eastern seaboard in the winter season acts to dramatically enhance the surface horizontal temperature gradients within the coastal zone. This is particularly true off the North Carolina coastline where, on average, the Gulf Stream is closest to land north of 32 degrees latitude. During winter offshore cold periods, these horizontal temperature gradients can result in rapid and intense destabilization of the atmosphere directly above and shoreward of the Gulf Stream. This air mass modification or conditioning period often precedes wintertime coastal extra-tropical cyclone development.

When jet stream disturbances (which create lift) move over this temperature gradient, surface low-pressure systems can form. Because of the abundant moisture from the ocean and temperature gradient of the coastal front, these storms can develop explosively.

It is the temperature structure of the continental air mass and the position of the temperature gradient along the Gulf Stream that drives this cyclone development. As a low pressure deepens, winds and waves can uninhibitedly increase and cause serious damage to coastal areas as the storm generally moves to the northeast.

The coastal counties of North Carolina are most vulnerable to the impacts of nor'easters. Since the storms typically make landfall with less warning than hurricanes (due to their rapid formation right along the coast), residents may be caught at home unprepared. On the other hand, nor'easters typically occur during the off-season when fewer non-residents are visiting the coast. As with hurricanes, vulnerability is proportional to structural strength, with mobile homes particularly vulnerable.

A scale, similar to the Saffir-Simpson scale for hurricanes, has been developed by Robert Davis and Robert Dolan (1993). The Dolan-Davis scale is shown below.

Table 6. Dolan-Davis Nor'easter Scale

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage	Duration (measured in number of tidal cycles)
I (Weak)	Minor changes	None	No	No	Up to 1 tide
II (Moderate)	Modest; mostly to lower beach	Minor	No	Modest	Up to 2 tides
III (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level	2 to 3 tides
IV (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community- scale	3 to 4 tides

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage	Duration (measured in number of tidal cycles)
V (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars	4 to 5 tides

Table 7. Nor'easters from 1942 to 1984

Storm Class	Number of Storms	Percentage of Total
I – Weak	670	49.7
II – Moderate	340	25.2
III – Significant	298	22.1
IV – Severe	32	2.4
V – Extreme	7	0.1

Source: Dolan, Robert and Robert E. Davis. "An Intensity Scale For Atlantic Coast Northeast Storms." *Journal of Coastal Research*. Vol. 8:4, pp. 840-853.

Probability of Future Events

Each year, there is an average of 22 to 35 nor'easters that have a minor impact along the mid-Atlantic coast, according to research based on 50 years of data by Dolan and Davis. Over the past 10 years, there has been an average of 2 to 3 Class IV and V nor'easters. This rate is expected to remain the same for the near future. (**Highly Likely** likelihood of occurrence).

Nor'easters, when threatening Southern Shores, impact a **Large** proportion of the town's jurisdiction. The weaker storms, Classes I, II, and III – are most common from December to April. The stronger nor'easters, Classes IV and V, typically occur in October, January, and March.

Impact of a nor'easter on the town would be **Limited**.

The area in and around Southern Shores has experienced several major nor'easters.

The Ash Wednesday Storm of 1962 produced the most extensive damage recorded to date along this section of the Outer Banks. Water inundated Sea Crest Village and was impounded by the dune for 10 days. David Stick's account, *The Ash Wednesday Storm*, is filled with photographs of the storm damage.

The Halloween Storm in 1991 had a storm surge measurement of less than 3', but the wave period was 18-21 seconds versus the 8-12 seconds typical of northeasters. This is rare for the Atlantic. The unusually long wave periods allowed the run-up to reach much higher elevations and to deposit overwash sand higher and farther inland than has been seen in several decades. The result was extensive flooding between the beach road and the bypass in Kitty Hawk and Kill Devil Hills. The higher run-up pumped water over the beach road into the low areas between the two roads. Unofficial reports of water marks indicate that in some areas the inland flooding may have reached three times higher than the ocean surge elevations (Spencer Rogers – Sea Grant).

The March 1993 "Storm of the Century" caused extensive flooding along soundfront properties on North Dogwood Trail in Southern Shores. This storm pummeled soundside residents with gale force winds for over 12 hours causing flooding and debris removal problems for over a month after the event. It generated water levels up to 7.5 feet above mean sea level.

When the Town of Southern Shores encounters either a hurricane, thunderstorm or tornado, there will also be high winds associated with these types of storms. In order to limit damage, in terms of property, personal injuries and loss of life, which can result from high winds, the Town of Southern Shores has the following policies and programs in place:

North Carolina Building Code

The Town of Southern Shores has adopted the North Carolina Building Code that includes construction requirements for High Winds and Coastal Flooding and the International Building and International Residential Code which sets forth the building requirements as they pertain to the construction of buildings and houses in regards to their ability to withstand substantial winds.

Additionally, the Town participates in the Building Code Effectiveness Grading Schedule by ISO. New homeowners are informed of FEMA's Safe Room concept as a shelter of last resort within their home. A copy of the FEMA manual is in our office and contains construction details for various configurations.

Subdivision regulations as they deal with underground wiring

The Town of Southern Shores subdivision regulations require that the electrical wiring, telephone wiring and television cable in all new subdivisions be installed underground. This will eliminate the adverse effects that high winds normally have on exposed wiring and cables during hurricanes, thunderstorms and tornadoes.

Dominion NC Power line maintenance program

Dominion NC Power has a routine line maintenance program in place in which tree limbs located near power lines are trimmed and removed which dramatically reduces the occurrence of power line damage and power outages during periods of high wind activity which is associated with hurricanes, thunderstorms and tornadoes.

Inclement weather policy

In order to maximize the Town resources of manpower during an actual and/or expected hurricane, thunderstorm or tornado, the Town of Southern Shores has developed an inclement weather policy to insure that employees are properly notified and given job directions and instructions prior to and during times of inclement weather.

High Winds Policy

Wind borne debris protection for all glazed openings such as windows is included in the Building and Residential Codes adopted by the state and the Town of Southern Shores.

Technical & Fiscal Capabilities

The Town has the in-house technical expertise to enforce the Building Code.

Section 7: Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the air for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. An Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

People start more than four out of every five wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires.

North Carolina, with its large amount of wooded areas, is included among the states with a high risk of wildfire. As development has spread into areas of North Carolina which were previously rural, new residents have been relatively unaware of the hazards posed by wildfires and have used highly flammable material for constructing buildings. This has increased the threat of loss of life and property, and has also resulted in a greater population of people less prepared to cope with wildfire hazards. The southern coastal plain is particularly vulnerable to the wildfire hazard. The mountain region has also experienced wildfires.

Wildfire behavior is based on three primary factors: fuel, topography and weather

Fuel: The type and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components is also a factor, in that it expresses the pattern of vegetative growth and open areas.

Topography (slope) is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. In general terms, the steeper the slope of the land, the faster a fire can spread up the slope. A topographic map can help identify areas of the community with slopes less than 40%, between 41% and 60%, and greater than 61%, corresponding to low, moderate and steep gradients relative to the spread of wildfires.

Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity, and wind (both short and long term) affect the severity and duration of wildfires. Critical Fire Weather Frequency is a set of weather conditions, usually a combination of low relative humidity and wind, whose effects on fire behavior make control difficult and threaten firefighter safety. The average number of days per year of critical fire weather experienced in the community can be obtained from the local or state fire marshal, forestry department, or department of natural resources. The National Weather Service or NOAA Websites can help determine past weather conditions.

To determine fire hazard severity for the community, the Fire Hazard Severity Table below was used. There may be more than one classification in the community depending on the degrees of the slope and fuel models.

Table 8. Fire Hazard Severity

Fuel Classification	Critical Fire Weather Frequency								
	<1 Day / Year			2 to 7 Days/Year			>8 Days/Year		
	Slope (%)			Slope (%)			Slope (%)		
	<40	41-60	>61	<40	41-60	>61	<40	41-60	>61
Light Fuel	M	M	M	M	M	M	M	M	H
Medium Fuel	M	M	H	H	H	H	E	E	E
Heavy Fuel	H	H	H	H	E	E	E	E	E

Heavy Fuel is vegetation consisting of round wood 3 to 8 inches in diameter

Medium Fuel is vegetation consisting of round wood 1/3 to 3 inches in diameter

Light Fuel is vegetation consisting of herbaceous plants and round wood less than 1/4 inch in diameter

M = Moderate Hazard; **H** = High Hazard; **E** = Extreme Hazard

(source: FEMA Report No. 386-2)

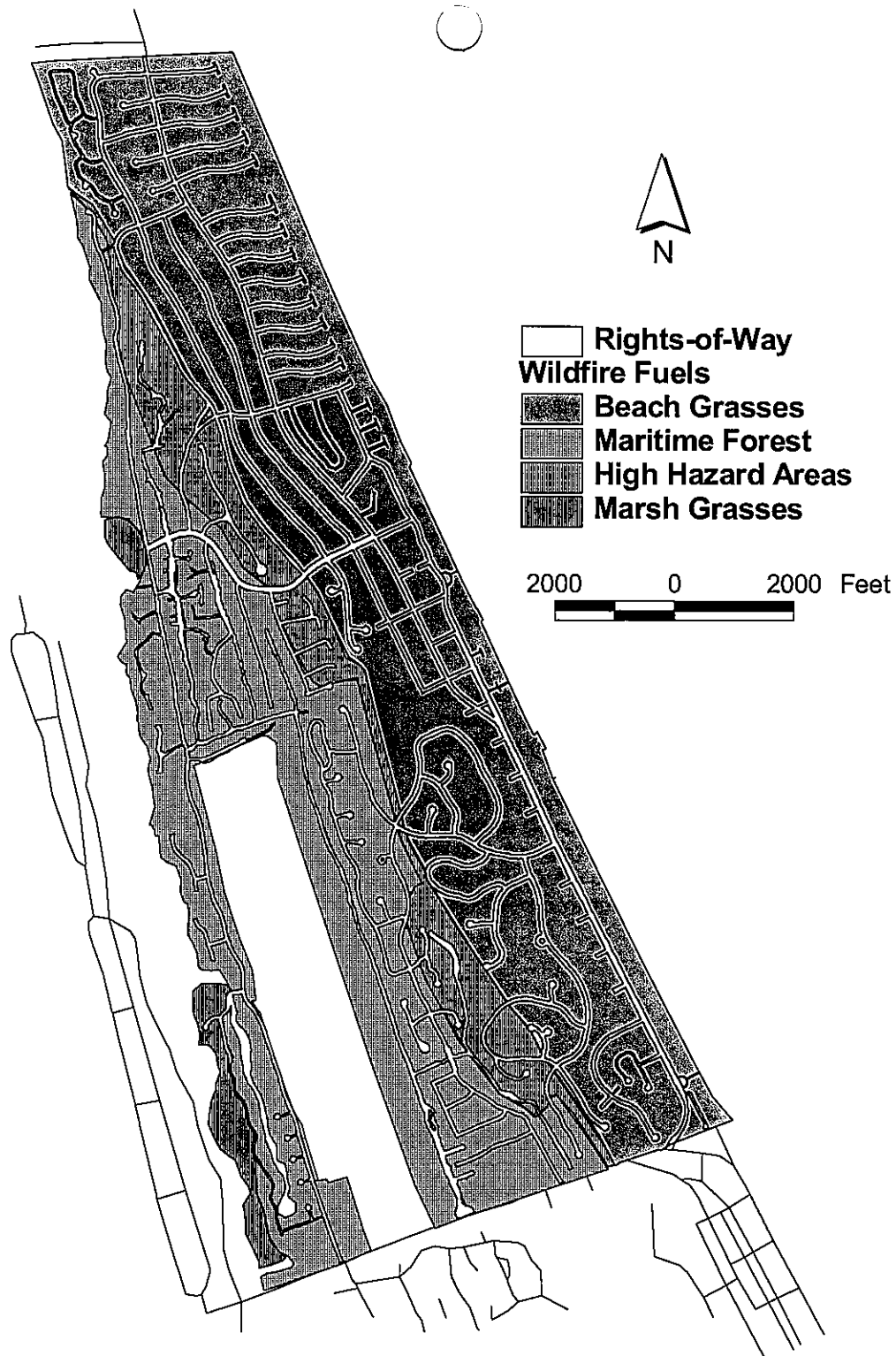
In Southern Shores, the types of vegetative fuels are cropland and pasture, forested lands, wetlands, and rangeland. The following table is a vulnerability assessment of the county, in regard to wildfire.

Table 9. Wildfire Vulnerability

Type of Fuel	Number of Persons / (2.3266 per acre)	Number of Households	Property Value at Risk
Beach grasses	2,729	1,173	\$141,770,100
Maritime forest	1,296	557	\$ 93,114,900
High hazard areas	351	151	\$ 19,124,900
Marsh grasses	21	9	\$ 1,217,700

Using Dare County's GIS data, the type of fuels' map was compared with the property values map. All properties with a building value greater than \$ 0 were selected from each fuel type and the building value sum of each fuel type was calculated. The number of households was multiplied by the number of persons per acre (according to the 2000 Census) to estimate the number of persons affected. These estimates do not take into account Southern Shores' average occupancy rates.

Figure 11. Wildfire Fuels



Probability of Future Events

Southern Shores has a **Possible** likelihood of occurrence. This trend is expected to continue.

Wildfires, when threatening Southern Shores, impact a **Small** proportion of the town's jurisdiction.

Impact of a wildfire on the town would be **Limited**.

There have been no recorded wildfires in the town's jurisdiction since incorporation in 1979.

Section 8: Thunderstorms

Thunderstorms

Thunderstorms are the result of convection in the atmosphere. They are typically the by-product of atmospheric instability, which promotes the vigorous rising of air parcels that form cumulus and, eventually, the cumulonimbus (thunderstorm) cloud. Instability can be caused either by surface heating or upper-troposphere (~50,000 feet) divergence of air (rising air parcels can also result from air flows over mountainous areas). Generally, the former "air mass" thunderstorms form on warm-season afternoons and are not severe. The latter "dynamically-driven" thunderstorms generally form in association with a cold front or other regional-scaled atmospheric disturbance. These storms can become severe, producing strong winds, frequent lightning, hail, downbursts and even tornadoes.

A typical thunderstorm may be three miles wide at its base, rise to between 40,000 to 60,000 feet in the troposphere, and contain half a million tons of condensed water. Conglomerations of thunderstorms along cold fronts (with squall lines) can extend for hundreds of miles. Thunderstorms contain tremendous amounts of energy derived from condensation of water. The half million tons of condensed water release 300 trillion calories of energy, equivalent to about 100 million kilowatt-hours of electricity, or several Hiroshima-sized atomic bombs.

According to the National Weather service, a severe thunderstorm is one that produces tornadoes, hail of 0.75 inches or more in diameter, or winds of 50 knots (58 mph) or more. Structural wind damage may imply the occurrence of a severe thunderstorm. Hail, formed by the accretion of super cooled liquid water on ice particles in a thunderstorm updraft, can pose a serious threat to agriculture and exposed objects. Likewise, strong winds can potentially wreak havoc on fragile or flimsy structures, or yield secondary damage through the downing of trees. Lightning associated with thunderstorms poses a threat to people and animals in unsheltered areas. The tornado, however, is by far the greatest natural hazard threat from a severe thunderstorm. (Source: Eugene Chilliemi, National Weather Service)

Thunderstorms are common throughout North Carolina and have occurred in all months of the year. Thunderstorm-related deaths and injuries in North Carolina peak during July and August. Visitors fishing on the open waters, golfing or swimming at the beach are at risk.

Probability of Future Events

Southern Shores has a **Highly Likely** likelihood of occurrence. Each year, thunderstorms occur in the town. This trend is expected to continue.

Thunderstorms, when threatening Southern Shores, impact a **Medium** proportion of the town's jurisdiction.

Impact of a thunderstorm on the town would be **Negligible**.

There has been 1 reported thunderstorm wind in the town that impacted the town (1995) and caused \$1,000 in property damages.

Section 9: Coastal Erosion

When property owners choose to build or buy on the oceanfront, they take risks. Those risks may come in the form of dramatic storms such as nor'easters or hurricanes that can destroy a home in a matter of hours. The risks may also develop more gradually, caused by the daily forces of winds, waves, and tides. These forces cause North Carolina's beaches to shift. A beach may lose sand (erosion) or gain it (accretion).

Erosion tends to occur faster in some areas than in others, especially near inlets and capes, where sand shifts rapidly. An eroding beach may lose several feet of sand a year. In spite of these risks, many people want to build along the ocean shore. The NC Coastal Resources Commission (CRC) has established rules and development standards to reduce the risk to life and property. These rules include erosion setbacks for oceanfront construction. These setbacks are based on average long-term erosion rates that reflect changes in the shoreline over nearly half a century.

North Carolina first evaluated long-term average erosion rates for the state's 300 mile ocean coastline in 1979. The Division of Coastal Management evaluates these erosion rates about every five years. It is an exacting process that takes about a year to complete. Coastal Management begins each update by obtaining new aerial photographs of the ocean shoreline. The photographs have been taken under specific conditions to ensure that the coast is in a normal condition as possible. The photos show the shoreline – defined as the high water line, or the edge of the wet sand visible in the photographs. The shoreline is marked, and its position (relative to a fixed shoreline baseline) is added to an existing database. A sophisticated computer program corrects for distortion created by the aerial photographs.

Another computer program determines an average long-term erosion rate by comparing the current shoreline position to the earliest available position and dividing the distance between them by the number of years that have passed between the dates the photographs were taken. For example, if the 1992 shoreline is compared with the 1942 shoreline, the distance the shoreline has moved is divided by 50. If the difference between 1942 and 1992 is 100 feet, the long-term average erosion rate is 2 feet per year.

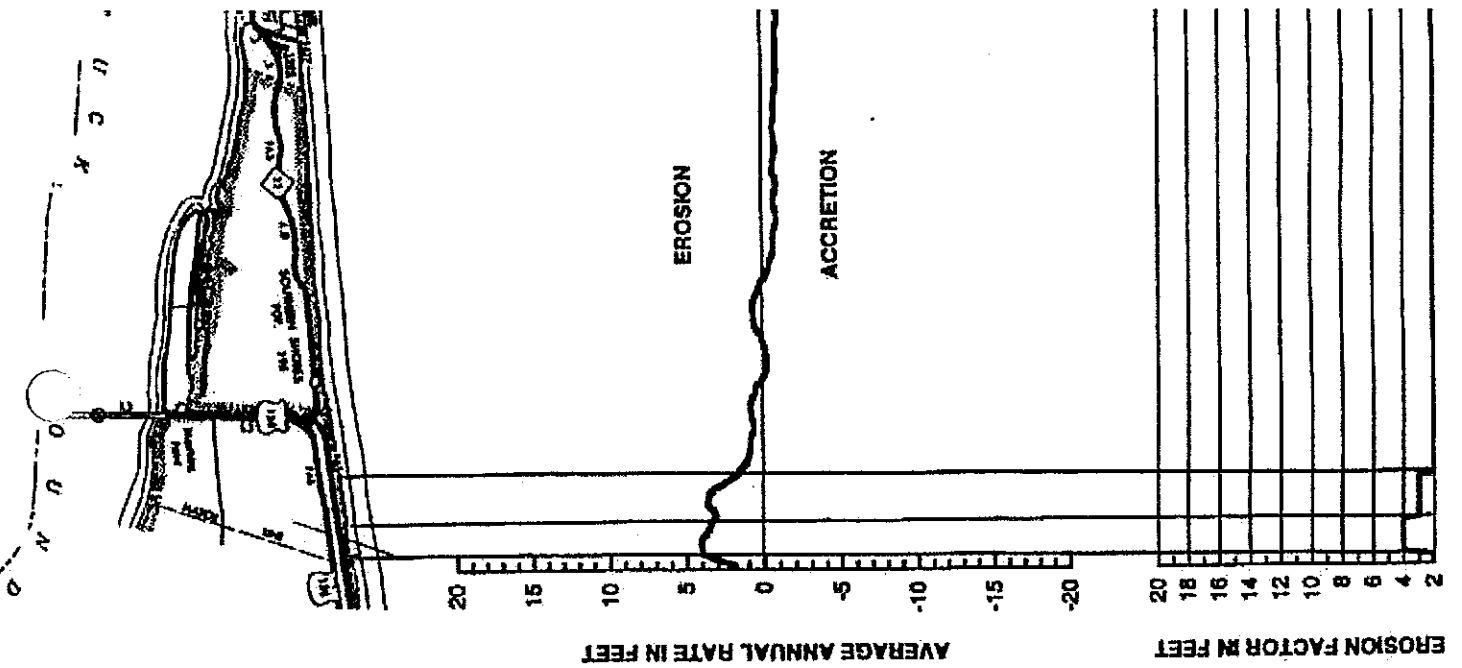
These erosion rates are not predictors. If the long-term average erosion at a certain location is 2 feet per year, it does not mean that the beach will lose 2 feet of sand this year. It might lose less than 2 feet, or more than 2 feet. The rates are useful for giving an idea of what has happened in the past.

The beach along the oceanfront is defined by the Coastal Area Management Act (CAMA) as an Ocean Erodible Area. The Area of Environmental Concern (AEC) extends from the mean low water line to the first line of stable natural vegetation plus, landward, 60 times the long-term erosion rate (which is 2 feet per year) plus 35 feet, or 155 feet. There is a minimum setback for single-family residences (small structures) from the first line of stable vegetation of 60 feet (30 yrs x 2 ft/yr). As it proceeds landward the beach area gives way to frontal and primary dunes of varying heights. A substantial dune ridge extends North and South through the middle of Town reaching elevations from 30' to 60' above mean sea level.

In the late 1930's, a Civilian Conservation Corps program constructed the beach dunes as an Erosion/Flood Protection System. It was stabilized with beach grass plantings. The grass trapped windblown sand and has allowed a substantial dune buildup that is essentially intact for the length of the Town along the Atlantic oceanfront.

Figure 12. Long Term Annual
(Source: NC Division of Coastal

Shoreline Changes
(Management)



Probability of Future Events

Southern Shores has a **Highly Likely** likelihood of occurrence. This trend is expected to continue.

Coastal erosion, when threatening Southern Shores, impacts a **Medium** proportion of the town's jurisdiction.

Impact of coastal erosion on the town would be **Negligible**.

There has been a long-term erosion rate of 2 feet per year.

Section 10: Tornadoes

A tornado is a violently rotating column of air extending to the ground. Over water, a tornado is called a *waterspout*. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long.

Tornadoes are among the most unpredictable of weather phenomena. Tornado season runs ordinarily from March through August; however, tornadoes can strike at any time of the year if the essential conditions are present.

Thunderstorms and hurricanes spawn tornadoes when cold air overrides a layer of warm air, causing the warm air to rise rapidly. The winds produced from hurricanes, earthquake-induced fires, and wildfires have also been known to produce tornadoes.

The nature of tornadoes is that they strike at random. While it is known that some areas of the country experience tornadoes more than others, predicting exactly what parts of your community have a greater chance of being struck by a tornado is difficult. In order to determine the likelihood and potential severity of tornado events in your community, you should ascertain the number and intensity of tornadoes that have affected the area in the past. Take note, however, that the past number and severity of events is not necessarily a predictor of future occurrences.

The majority of tornadoes (71%) reported in North Carolina have been classified as weak, 28% as strong, and about 1% as violent. Weak tornadoes have caused 3% of North Carolina tornado deaths, similar to the national figure. Strong tornadoes were responsible for 49% of North Carolina deaths (compared to 70% for the nation). Based on state tornado statistics (SERCC, 1996), North Carolina ranks 22nd in total number of tornadoes and 18th in tornado deaths for the period 1953-1995.

Although tornadoes have been reported in North Carolina throughout the year, most of them have occurred in the spring, with 13% in March, 11% in April, 22% in May and 14% in June. The most severe tornadoes have also taken place during the spring, with more than half of all F2 or stronger storms occurring in that season.

The mountains and northern piedmont of North Carolina experience the lowest frequency of tornadoes because of less favorable conditions for severe thunderstorm activity in those regions. The highest frequency of tornadoes historically has occurred in the southeastern portion of the State.

Tornadoes are characterized by damage pattern, FO through F5 on the Fujita-Pearson Tornado Scale. The table below shows the tornado category, expected damages, and corresponding wind speed.

Table 10. Fujita-Pearson Tornado Scale

F-Scale	Damage	Winds (mph)	Path Length (miles)	Mean Width (miles)
F0 (Weak)	Light	40-72	< 1	< 0.01
F1 (Weak)	Moderate	73-112	1-3.1	0.01-0.03
F2 (Strong)	Considerable	113-157	3.2-9.9	0.04-0.09

F3 (Strong)	Severe	158-206	10-31	0.1-0.31
F4 (Violent)	Devastating	207-260	32-99	0.32-0.99
F5 (Violent)	Incredible	261-318	≥ 100	> 1.0

Probability of Future Events

Southern Shores has a **Possible** likelihood of occurrence. This trend is expected to continue.

Tornadoes, when threatening Southern Shores, impact a **Small** proportion of the town's jurisdiction.

Impact of tornadoes on the town would be **Limited**.

There have been no tornadoes in Southern Shores' jurisdiction since the town was incorporated in 1979.

Section 11: Landslides

Common throughout the mountainous Appalachian region, landslides are described as downward movement of a slope and materials under the force of gravity. The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides are influenced by human activity (mining and construction of buildings, railroads, and highways), and natural factors (geology, precipitation, and topography).

Mudflows (or debris flows) are flows of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." Slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. Other types of landslides include: rock slides, slumps, mudslides, and earthflows. All of these differ in terms of content and flow.

Landslides occur when masses of rock, earth, or debris move down a slope. Therefore, gravity acting on an overly steep slope is the primary cause of a landslide. They are activated by storms, fires, and by human modifications to the land. New landslides occur as a result of rainstorms, earthquakes, and various human activities.

The best predictor of future landslides is past landslides because they tend to occur in the same places. Existing or old landslides may be found in the following areas:

- On or at the base of slopes;
- In or at the base of minor drainage hollows;
- At the base or top of an old fill slope;
- At the base or top of a steep cut slope; or
- Developed hillsides where leach field septic systems are used.

The following conditions may exacerbate the effects of landslides:

- Erosion: Erosion caused by rivers, glaciers, or ocean waves created by overly steep slopes.
- Unstable Slopes: Rock and soil slopes are weakened through saturation by snowmelt or heavy rains.
- Earthquakes: The shaking from earthquakes creates stress that makes weak slopes fail.
- Vibrations: Machinery, traffic, blasting, and even thunder may cause vibrations that trigger failure of weak slopes.
- Increase of Load: Weight of rain/snow, fills, vegetation, stockpiling of rock or ore from waste piles, or from man-made structures may cause weak slopes to fail.
- Hydrologic Factors: Rain, high water tables, little or no ground cover, numerous freeze/thaw cycles may cause weak slopes to fail.
- Human Activity: These include development activities such as cutting and filling along roads and removal of forest vegetation. Such activities are

capable of greatly altering slope form and ground water conditions which can cause weak slopes to fail.

- Removal of Lateral and Underlying Support: Erosion, previous slides, road cuts and quarries can trigger failure of weak slopes.
- Increase of Lateral Pressures: Hydraulic pressures, tree roots, crystallization, swelling of clay soil may cause weak slopes to fail.
- Regional Tilting: Geologic movements can trigger weak slopes to fail.

The three most useful types of landslide maps are: 1) landslide inventories; 2) landslide susceptibility maps; and 3) landslide hazard maps.

- Landslide Inventories: Landslide inventories identify areas that appear to have failed due to landslides, including debris flows and cut-and-fill failures. Detailed inventories depict and classify each landslide and show scarps, zones of depletion and accumulation, active versus inactive slides, geological age, rate of movement, and other pertinent data on the depth and type of materials involved in sliding. Overlaying a geologic map with an inventory map that shows existing landslides can identify specific landslide-prone geologic units. For this reason, a landslide inventory is essential for preparing a landslide susceptibility map.
- Landslide Susceptibility Maps: Landslide susceptibility maps depict areas that have the potential for landslides by correlating some of the principal factors that contribute to landslides - steep slopes, geologic units that lose strength when saturated, and poorly drained rock or soil - with the past distribution of landslides. These maps indicate the relative stability of slopes; however, they do not make absolute predictions. More complex maps may include additional information such as slope angle, and drainage.
- Landslide Hazard Maps: Landslide hazard maps show the real extent of the threat: where landslides have occurred in the past, where they are likely to occur now, and where they could occur in the future. They contain detailed information on the types of landslides, extent of slope subject to failure, and probable maximum extent of ground movement. These maps can be used to predict the relative degree of hazard in a landslide area.

Landslide Areas in Southern Shores

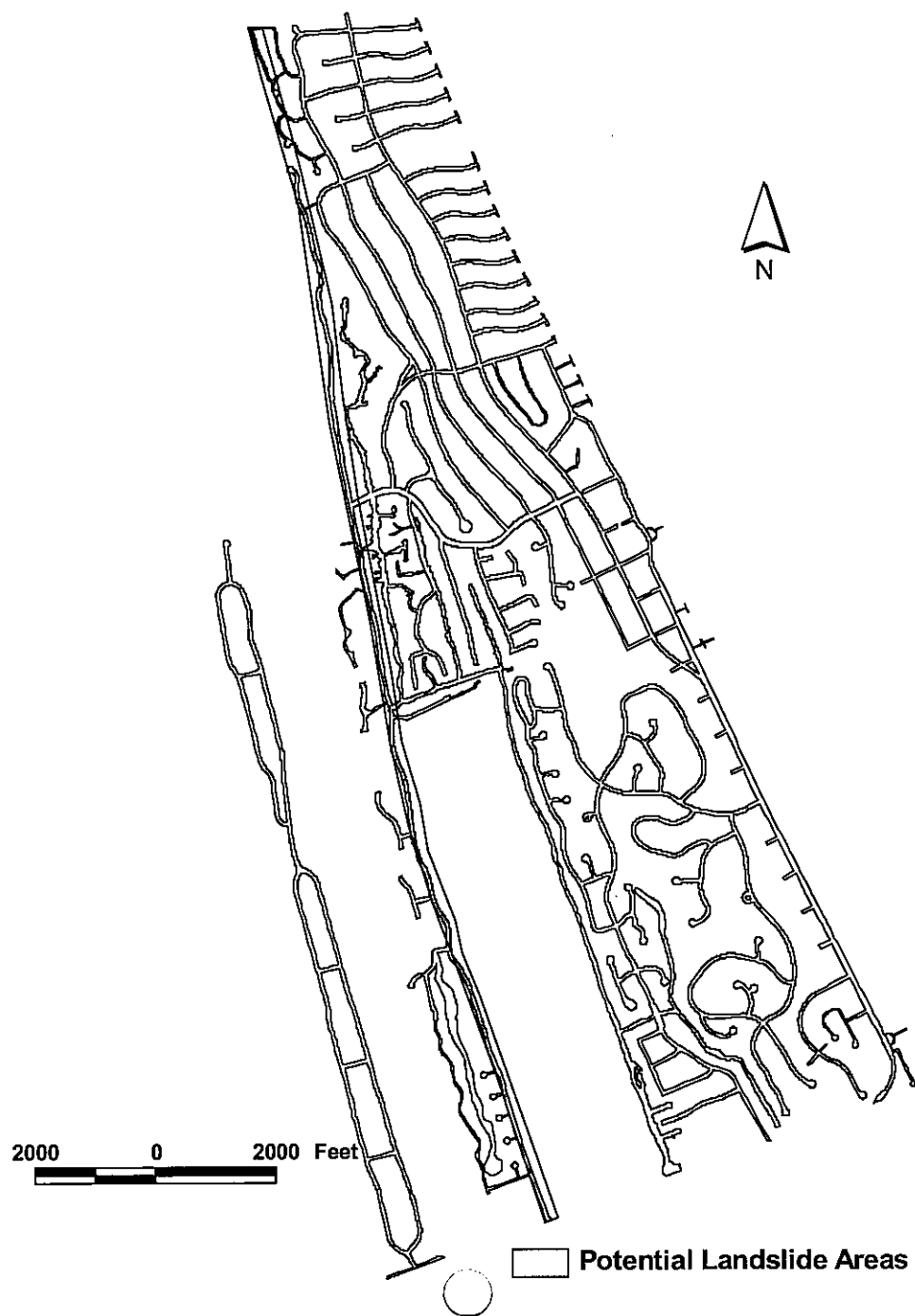
Sound front property along the Northern portion of North Dogwood, Kingfisher, and Soundview Trails and North Dune Loop is susceptible to landslides. These properties are characterized by high bluffs at the waters edge. Storms cause elevated water levels and damaging waves in Albemarle and Currituck Sound. Breaking waves can overtop existing bulkheads and rip rap. Older bulkheads can be undermined with an associated loss of backfill.

The potential landslide areas identified in Southern Shores are not the typical landslide areas found in other regions with more topographic variation. In Southern Shores, these high bluffs along the sound are not expected to erode to the point of endangering principal structures on the properties.

Sinkholes do not threaten Southern Shores.

The following figure shows the areas along the sound that are identified as 'landslide areas' for purposes of this plan.

Figure 13. Landslide Areas



Probability of Future Events

Southern Shores has an **Unlikely** likelihood of occurrence. Soundside erosion, responsible for landslides within Southern Shores, is expected to continue, but no source of long term erosion rate is available for the soundside shoreline.

Landslides, when threatening Southern Shores, impact a **Small** proportion of the town's jurisdiction.

Impact of landslides on the town would be **Negligible**.

There have been no landslides since Southern Shores was incorporated.

Section 12: Severe Winter Storms

Severe winter storms can produce an array of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets and extreme cold. Extreme snow events are the most potentially disruptive to society, for they can bring down power lines, trees and lead to roof collapses. All forms of severe winter weather can make traveling treacherous. Severe winter storms are extra-tropical cyclones fueled by strong temperature gradients and an active upper-level jet stream. The winter storms that impact North Carolina generally form in the Gulf of Mexico or off the southeast Atlantic Coast. Few of these storms result in blizzard conditions, defined by the presence of winds in excess of 35 mph, falling and blowing snow, and a maximum temperature of 20 degrees Fahrenheit.

While the frequency and magnitude of snow events are highest in the mountains due to elevation, the geographical orientation of the mountains and Piedmont contribute to a regular occurrence of freezing precipitation events (e.g., ice pellets and freezing rain) in the Piedmont. Such ice events (up to and including ice storms) are often the result of cold air damming (CAD). CAD is a shallow, surface-based layer of relatively cold; stably-stratified air entrenched against the eastern slopes of the Appalachian Mountains. With warmer air above, falling precipitation in the form of snow melts, then becomes either super cooled (liquid below the melting point of water) or re-freezes. In the former case, super cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet).

Probability of Future Events

Southern Shores has a **Possible** likelihood of occurrence.

Severe winter storms, when threatening Southern Shores, impact a **Large** proportion of the town's jurisdiction.

Impact of severe winter storms on the town would be **Negligible**.

There have been no severe winter storms since Southern Shores was incorporated.

The entire state of North Carolina has a likelihood of experiencing severe winter weather. The threat varies by location and by type of storm. Coastal areas typically face their greatest threat from nor'easters and other severe winter coastal storms. These storms can contain strong waves and result in extensive beach erosion and flooding. Freezing rain and ice storms typically occur once every several years at coastal locations and severe snowstorms have been recorded occasionally in coastal areas.

Cold air damming contributes to elevated freezing rain and ice storm events in the Piedmont of North Carolina. These events occur at least as often as moderate or severe snow events in this region.

The mountains of North Carolina usually receive several snowfalls of 4 to 6 inches in a given winter weather season. There has been at least one severe winter storm at some location in the mountains each year for the past several decades. The western area of the state is more likely to experience greater and more frequent snowfalls and blizzards than other locations in the state. The mountains also have the highest number of extreme one-day snowfalls.

When the Town encounters severe winter weather it may also experience either an accumulation of ice, snow or both. In order to reduce or eliminate the damage, in terms of property, personal injuries and loss of life, which can result from an accumulation of ice, the Town of Southern Shores has the following policies in place:

North Carolina Building Code

The Town has adopted the North Carolina Building Code, Volume 7, chapter 8, and the International Building Code which sets forth the building requirements as they pertain to the construction of buildings and houses in regards to the weight requirements for their roofs. One of the intents of this requirement is to insure that the roof can withstand the weight of ice accumulation.

Subdivision regulations as they deal with underground wiring

The Town of Southern Shores subdivision regulations require that the electrical wiring, telephone wiring and television cable in all new subdivisions be installed underground. This will eliminate the adverse effects that the accumulation of ice can have on exposed wiring and cables during severe winter weather.

NC Dominion Power line maintenance program

NC Dominion Power has a routine line maintenance program in place in which tree limbs located near power lines are trimmed and removed which dramatically reduces the occurrence of power line damage and power outage during periods of ice accumulation which is associated with severe winter weather.

Gaps, Shortfalls or Conflicts with Severe Winter Storms Policy

Due to the expense of such equipment, the Town is unable to purchase ice removal equipment in order to have the streets and sidewalks cleared of ice. In addition, the Town is unable to subcontract with anyone for ice removal.

Technical & Fiscal Capabilities

The Town has the in-house technical expertise through the Code Enforcement Department and the town engineer to enforce the policies, programs and ordinances which are under the authority of the Town as they deal with mitigating damage related to the accumulation of ice associated with severe winter weather.

There are existing overhead lines in Seacrest Village and along Ocean Boulevard, with transformers on poles near the oceanfront in sections of town from early development. Most homes have electric heat pumps for power and may or may not have LP gas for back up heat. Loss of electric power in the community for an extended period of time would be a problem. Another problem with the Town's large number of rental homes (which may be unoccupied in the winter) is that some might be improperly winterized or those on pilings may be improperly insulated. These situations could lead to costly homeowner insurance claims when frozen pipes thaw out causing water damage.

Section 13: Earthquakes

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of Earth's tectonic plates. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and after just a few seconds can cause massive damage and extensive casualties.

The variables that characterize earthquakes are ground motion, surface faulting, ground failure, and seismic activity.

Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions.

Surface faulting is the differential movement of two sides of a fracture - in other words, the location where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults.

Liquefaction is the phenomenon that occurs when ground shaking causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength. Lateral spreads develop on gentle slopes and entail the sidelong movement of large masses of soil as an underlying layer liquefies. Loss of bearing strength results when the soil supporting structures liquefies. This can cause structures to tip and topple.

Earthquakes are measured in terms of their magnitude and intensity. There are several different scales that are commonly used, including Richter Magnitude, Modified Mercalli Intensity (MMI), Moment Magnitude and Peak Ground Acceleration (PGA), among others.

Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a 244-fold increase in energy.

Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale. It is a twelve-level scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using Roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Scale of Earthquake Intensity (and its correspondence to the Richter Scale) is below.

Earthquakes are relatively infrequent but not uncommon in North Carolina. Epicenters of North Carolina earthquakes are generally concentrated in the active Eastern Tennessee Seismic Zone, which is second in activity in the eastern United States only to the New Madrid Fault.

The Eastern Tennessee Seismic Zone is part of a crescent of moderate seismic activity risk extending from Charleston, South Carolina northwestward into eastern Tennessee and then curving northeastward into central Virginia. While there have not been any earthquakes with a MMI intensity greater than IV since 1928 in this area, it has the potential to produce an earthquake of significant intensity in the future.

North Carolina's vulnerability to earthquakes decreases from west to east in relation to the Eastern Tennessee Seismic Zone. Generally, there are three different zones of seismic risk in North Carolina that correspond to different effective peak velocity-related accelerations of ground movement. The eastern portion of the State faces minimal effects from seismic activity. Locations in the middle and southeastern areas of the State face a moderate hazard from seismic activity, while the area from Mecklenburg County west through the Blue Ridge faces the greatest risk from seismic activity. These different levels of risk correspond to proximity to areas with historical seismic activity and changes in topography.

The steep topography of western North Carolina exacerbates the potential for damage from this area of seismic activity. There could be significant ground movement on steep slopes from seismic activity, which could result in human injuries, damage to property, and road closures, which would add to the difficulty of bringing in relief supplies and fire protection equipment.

Table 11. Modified Mercalli Scale of Earthquake Intensity

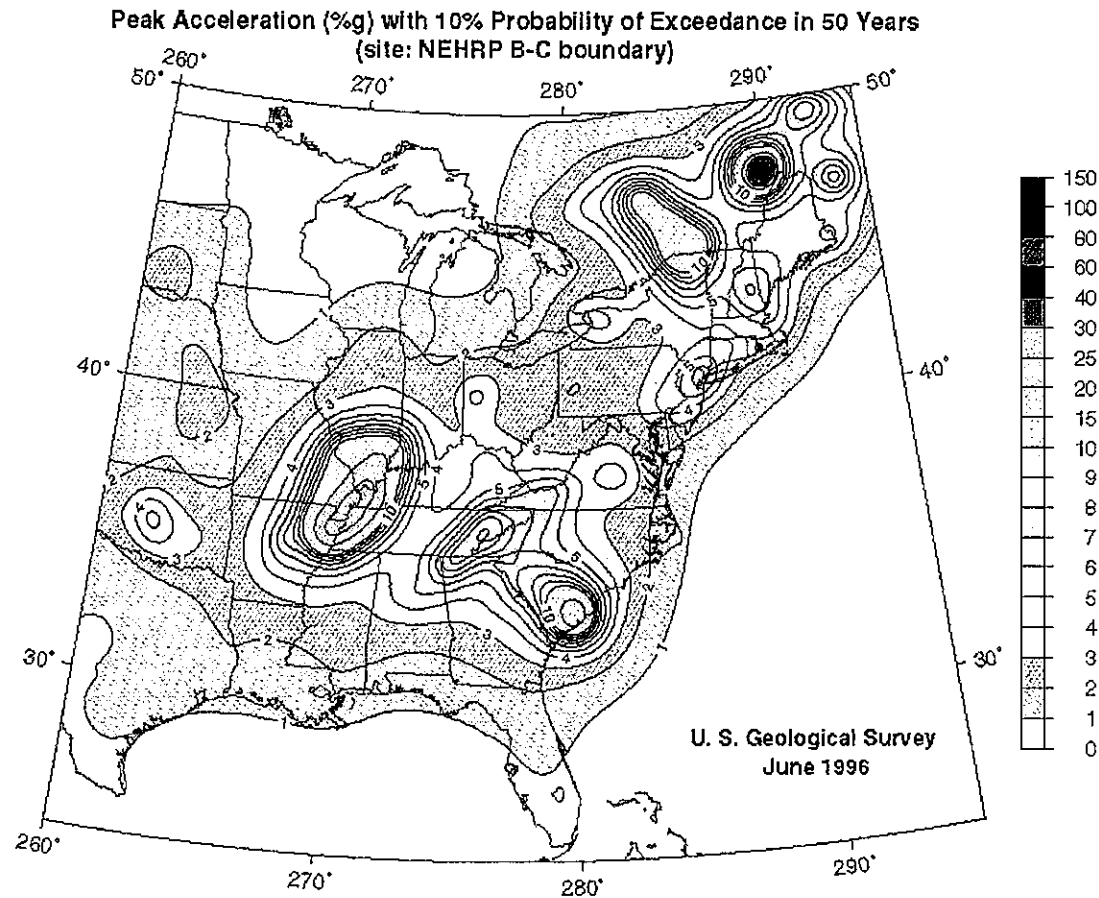
Scale	Intensity	Description of Effects	Maximum Acceleration (mm/sec)	Corresponding Richter Scale
I	Instrumental	Detected only on seismographs	<10	
II	Feeble	Some people feel it	<25	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	<50	
IV	Moderate	Felt by people walking	<100	
V	Slightly Strong	Sleepers awake; church bells ring	<250	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<500	<5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<1000	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	<2500	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<5000	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7500	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<9800	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>9800	>8.1

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. If you're standing on the surface of the earth and drop an object (ignoring wind resistance), it will fall toward the earth faster and faster, until it reaches terminal velocity. This principle is known as acceleration and represents the rate at which speed is increasing. The acceleration due to gravity is often called "g", a term you may have heard associated with roller coasters, rockets, or even stock car racing. The acceleration due to gravity at the earth's surface is 9.8 meters (980 centimeters) per second squared. That means that every second that something falls toward the surface of earth its velocity increases 9.8 meters per second. A 100% g earthquake is very severe.

An analogy would be if you floor your car's gas pedal and your groceries get smashed against the back of the trunk. The quicker you press on the gas, the more eggs are likely to get broken. That's because the quick acceleration caused the contents of your trunk to shift rapidly and violently, not slowly and smoothly. In fact, the eggs might not have moved at all if you had sped up slowly. The same thing is true in an earthquake. If ground acceleration is rapid, more things tend to break than if the shaking is relatively slow, even if the ground moves the same distance.

The map shows the national Peak Ground Acceleration (PGA) values for the United States with a 10% chance of being exceeded over 50 years. This is a common earthquake measurement that shows three things: the geographic area affected, the probability of an earthquake of each given level of severity (10% chance in 50 years), and the severity.

Figure 14. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years



Source: <http://geohazards.cr.usgs.gov>

Probability of Future Events

Southern Shores has an **Unlikely** likelihood of occurrence. There is a 10% chance of an earthquake exceeding 1% g in a 50 year period.

Earthquakes, when threatening Southern Shores, impact a **Large** proportion of the town's jurisdiction.

Impact of earthquakes on the town would be **Catastrophic**.

There have been no earthquakes since Southern Shores was incorporated.

Section 14: Flooding

Tropical systems and nor'easters are the primary source of flooding in Southern Shores. The extent to which areas within the Town of Southern Shores will be flooded is determined by modeling of predicted events against the elevation of lands being flooded. The Town topography features a sand beach along the Atlantic Ocean, manmade dune line, ocean overwash area, prominent dune ridge and maritime forest / bluff area on Currituck Sound.

One representation of the Town's flood hazard area is illustrated by the Flood Insurance Rate Map (FIRM). Flood hazard areas in coastal regions are determined using statistical analyses of records of storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. A FIRM usually is issued following a flood risk assessment conducted in connection with the community's conversion to the Regular Phase of the NFIP. If a detailed assessment, termed a Flood Insurance Study, has been performed, the FIRM will show base flood elevations and insurance risk zones in addition to floodplain boundaries. After the effective date of the FIRM, the community's floodplain management ordinance must be in compliance with appropriate Regular Phase requirements. Actuarial rates, based on the risk zone designations shown on the FIRM, are then applied for newly constructed, substantially improved, and substantially damaged buildings.

The 1993 FIRM designates three types of floodplain within the jurisdiction of Southern Shores. *This map represents a 1% (one-percent flood - 1/100) as the most infrequent event to be protected against. A one-percent flood, formerly called a 100-year flood, is a flood that would be exceeded in severity only once every hundred years on average.*

- VE Zone: (BFE 18') Oceanfront property is predicted to experience breaking waves;
- AO Zone: (1' depth) Oceanfront property in shallow flooding areas, no velocity. Ocean overwash from breached dunes; and
- AE Zone: (BFE 8') Soundside property flooded by rising water to a depth of 8 feet or more.

The FIRM designates the X Zone as an area beyond the reach of the 1% flood.

Base flood elevations (BFE) along the oceanfront on the FIRM, effective September 20, 2006, are 12' along virtually all of the eastern edge of town. This VE Zone boundary abuts the AE zones with base flood of 9' and 9.4', which flows across parts of Ocean Blvd and Duck Road in places

Base flood elevations along the soundside are 7' - on the FIRM effective September 20, 2006 in the AE Zone.

Figure 15 shows the current FIRM 2006 flood zones. Figure 16 shows the FIRM 1993 flood zones. It should be noted that the FIRM does not include the impact of long-term erosion anticipated by the State of North Carolina's CAMA regulations.

Additionally, the Town's vulnerability to inundation by specific hurricane Categories has been assessed using the National Weather Service's SLOSH model. SLOSH (Sea, Lake and Overland Surges from Hurricanes) is a computerized model run by the National Hurricane Center (NHC) to model storm surge heights and winds resulting from historical, hypothetical, or predicted hurricanes by taking into account the following variables:

- Pressure
- Size
- Forward speed
- Track
- Winds

Graphical output from the model displays color-coded storm surge heights for a particular area in feet above the model's reference level, the National Geodetic Vertical Datum (NGVD), which is the elevation reference for most maps. The calculations are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads and other physical features.

There is a difference between the FIRM and the SLOSH models.

The SLOSH model is generally accurate within plus or minus 20 percent. For example, if the model calculates a peak 10 foot storm surge for the event, you can expect the observed peak to range from 8 to 12 feet. The model accounts for astronomical tides (which can add significantly to the water height) by specifying an initial tide level, but does not include rainfall amounts, river flow, or wind-driven waves. However, this information is combined with the model results in the final analysis of at-risk areas.

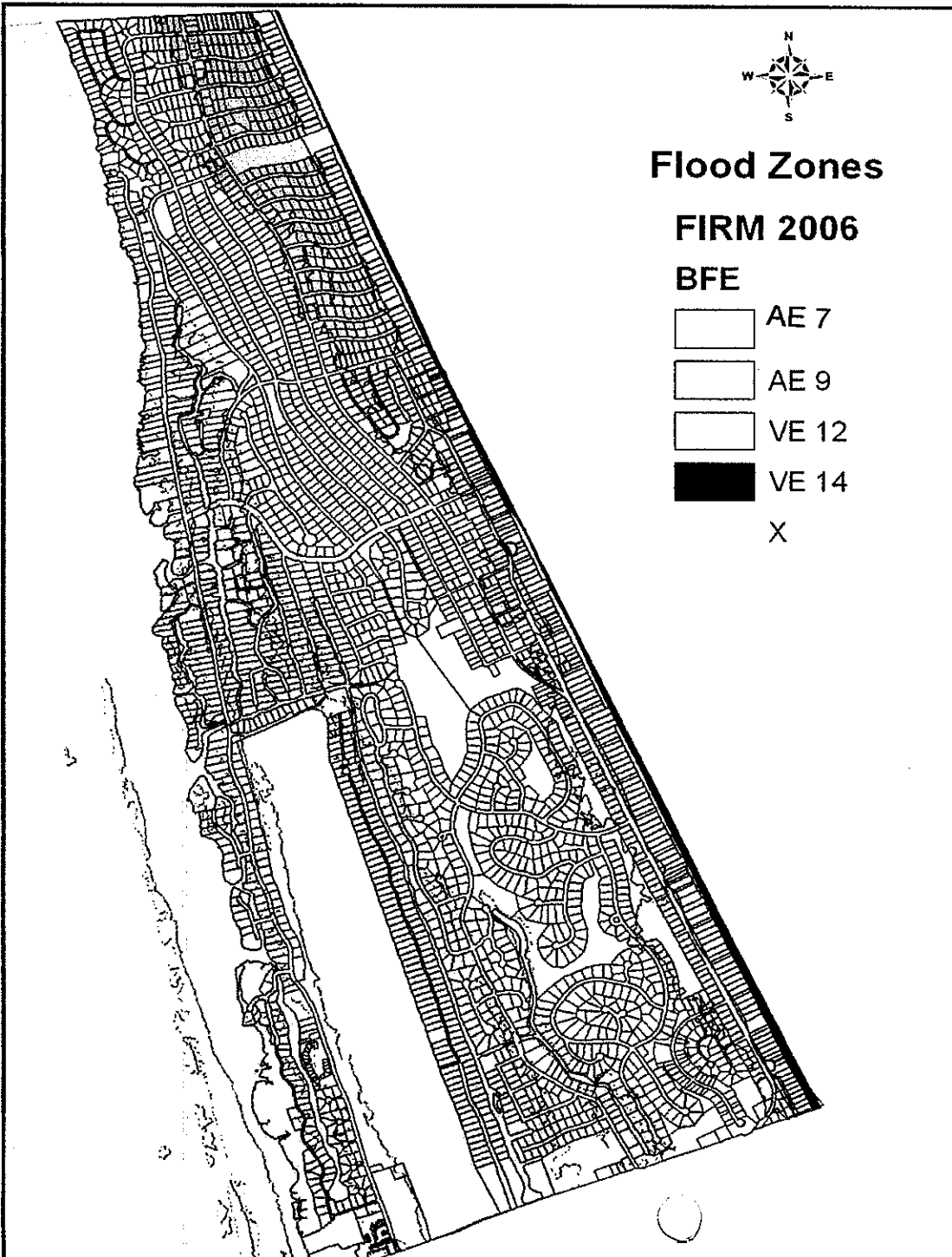
The point of a hurricane's landfall is crucial to determining which areas will be inundated by the storm surge. Where the hurricane forecast track is inaccurate, SLOSH model results will be inaccurate. The SLOSH model, therefore, is best used for defining the potential maximum surge for a location.

Two versions of the SLOSH model exist: (1) a slow moving hurricane model (less than 15 mph); and (2) a fast moving hurricane model (15 mph or greater). Typically, hurricanes move through the area at 15 mph or greater. Figures 17 and 18 depict both the slow and fast versions of the SLOSH model. The contribution from nor'easters to the overall storm-surge elevation in the area of the Town of Southern Shores can be significant, resulting in erosion to the beach and dune line. The wave action associated with storm surge can be much more damaging than the high water level.

Storms which produce flooding conditions along the oceanfront may not necessarily inundate property along the sound or canals. By the same token, a hurricane that comes up the Pamlico, Albemarle, and Currituck Sounds may create a storm surge that floods most canal front portions of Southern Shores.

Seawater impounded behind the frontal dune after a storm event can adversely impact septic drain fields and may block traffic on NC 12, the only road to the northern beach developments of Duck, Sanderling, Palmers Island, Ocean Sands, Corolla, Monterey Shores, etc. Any breach in the dune system will probably flood this road; halt traffic, and strand residents and tourists. Any significant damage to the dune system will require rebuilding at significant cost.

Figure 15. FIRM 2006



Figure

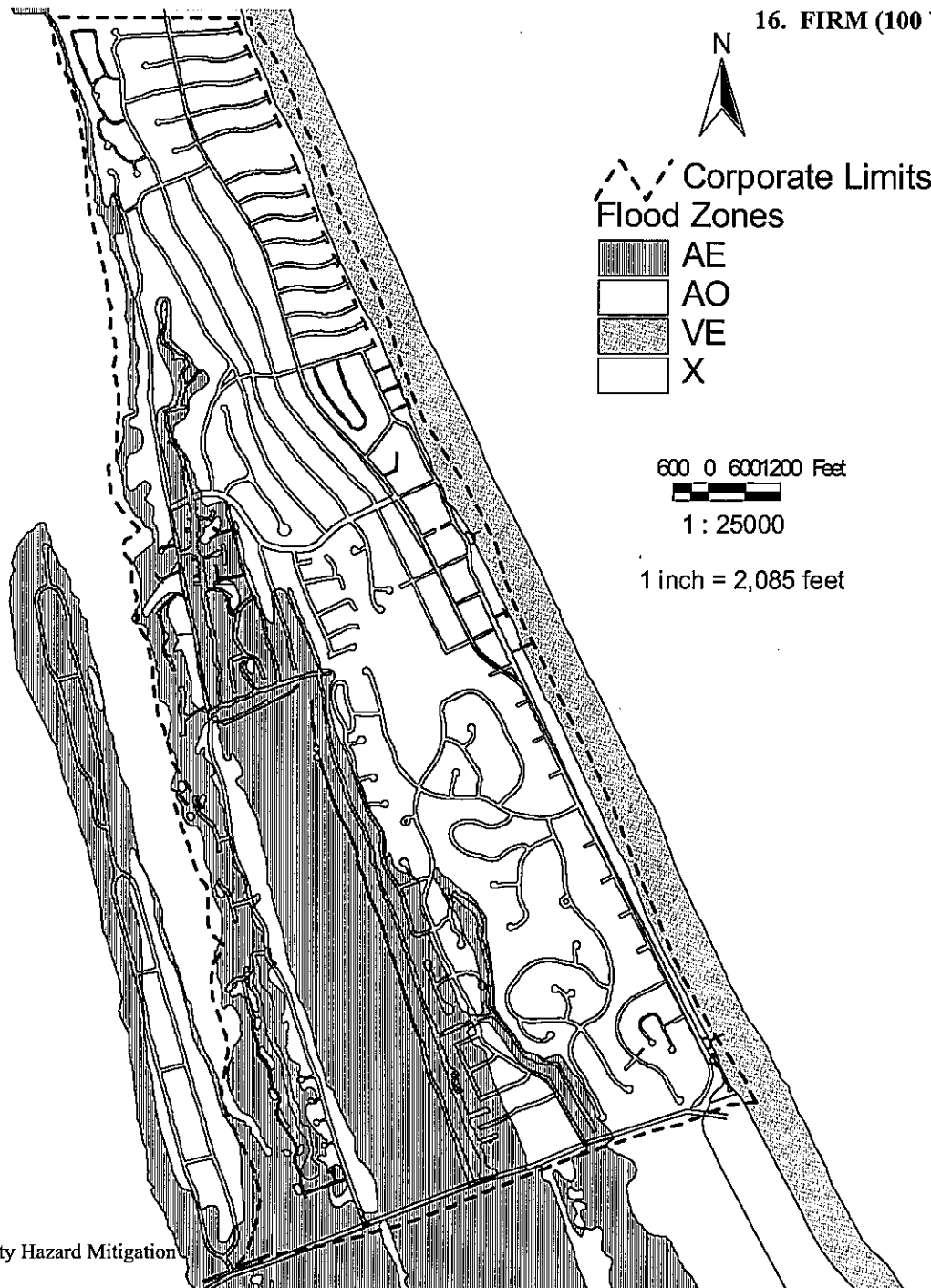


Figure 17. SLOSH Model –

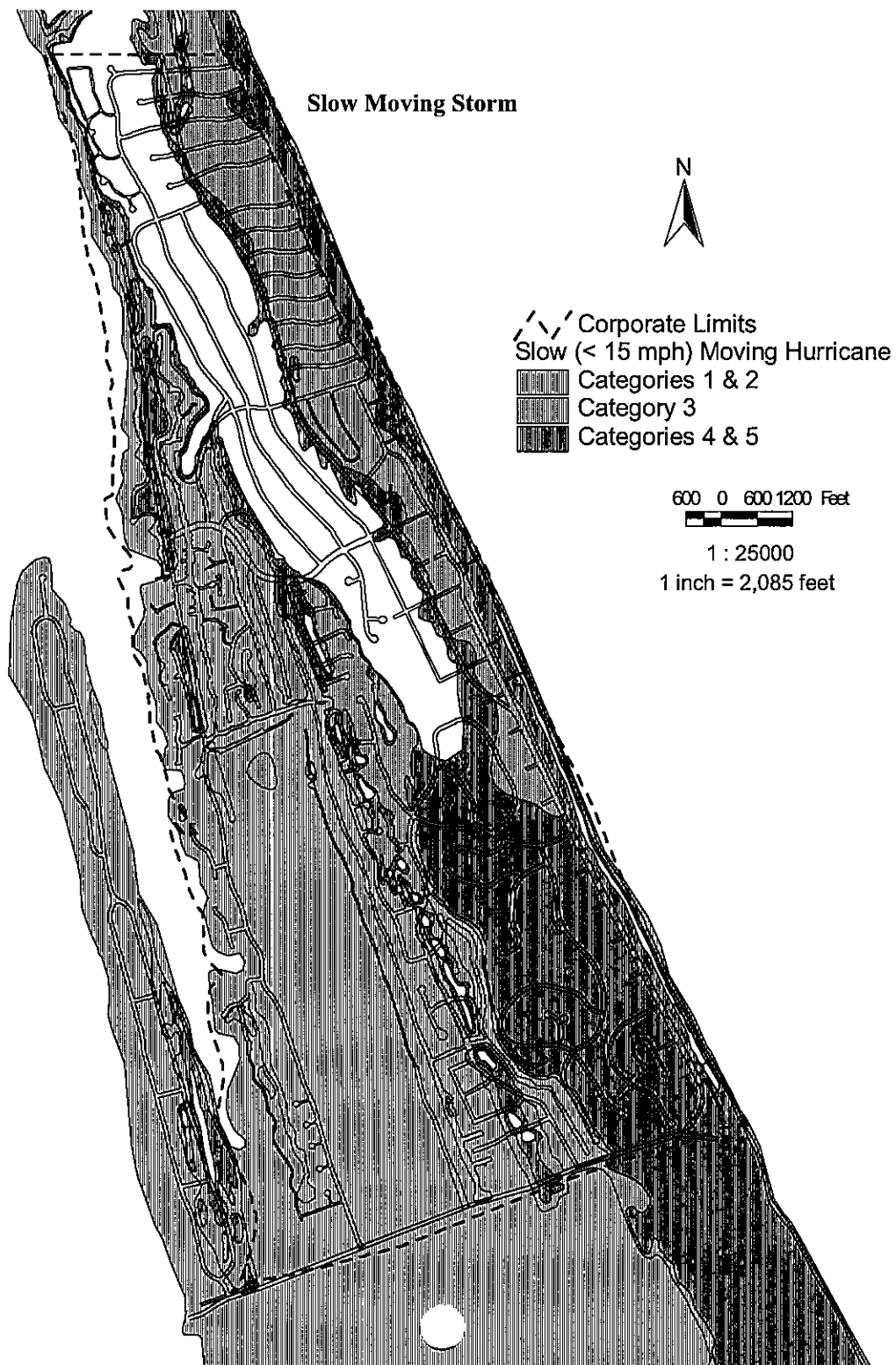
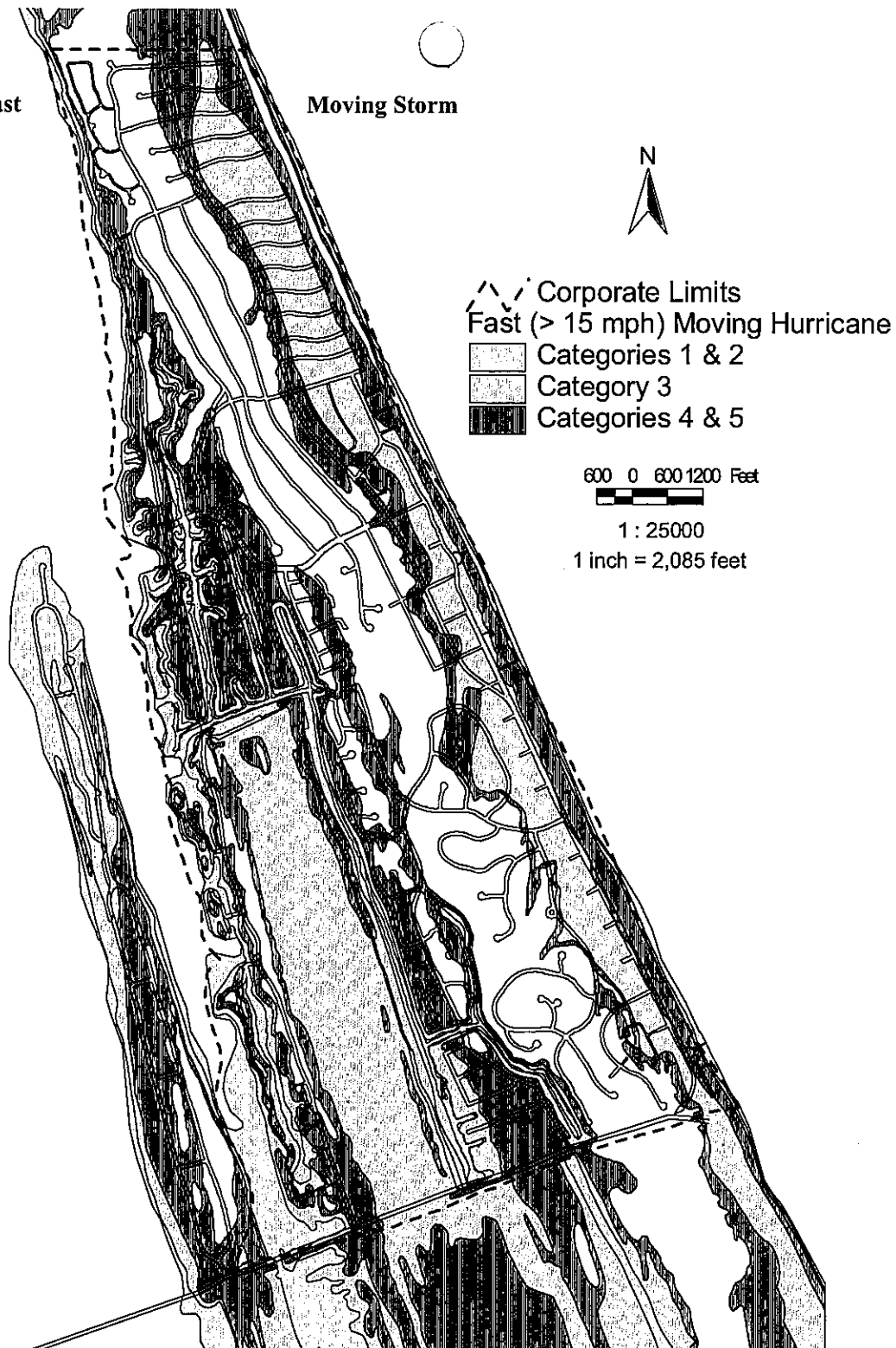


Figure 18. SLOSH Model - Fast



Previous Occurrences / Historical Flood Damage

The Ash Wednesday Storm of 1962 produced the most extensive damage recorded to date along this section of the Outer Banks. Water inundated Sea Crest Village and was impounded by the dune for 10 days. David Stick's account, *The Ash Wednesday Storm*, is filled with photographs of the storm damage.

The Halloween Storm in 1991 had a storm surge measurement of less than 3', but the wave period was 18-21 seconds versus the 8-12 seconds typical of northeasters. This is rare for the Atlantic. The unusually long wave periods allowed the run-up to reach much higher elevations and to deposit overwash sand higher and farther inland than has been seen in several decades. A result was the extensive flooding between the beach road and the bypass in Kitty Hawk and Kill Devil Hills. The higher run-up pumped water over the beach road into the low areas between the two roads. Unofficial reports of water marks indicate that in some areas the inland flooding may have reached three times higher than the ocean surge elevations (Spencer Rogers – Sea Grant).

The March 1993 "Storm of the Century" caused extensive flooding along soundfront properties on North Dogwood Trail in Southern Shores. This storm pummeled soundside residents with gale force winds for over 12 hours causing flooding and debris removal problems for over a month after the event. It generated water levels up to 7.5 feet above mean sea level.

Hurricane Emily, a Category 3 hurricane, grazed Hatteras Island on August 31, 1993. The eye of the hurricane came within 20 miles of Cape Hatteras, but did not pass over the Outer Banks. When the winds shifted from the northeast to the northwest, water was forced onto the island from Pamlico Sound, washing several homes from their foundations. Wind measuring equipment recorded wind gusts of up to 107 miles per hour.

Hurricane Isabel, a Category 2 storm, made landfall north of Cape Lookout on September 16, 2003. Southern Shores fared well as hurricane force winds moved through the area. There was no flood damage reported. However, wind damage and clean up after the storm was estimated at \$1 million.

Probability of Future Hazard Events

It is not economically justifiable to attempt to provide protection against the largest flood that could occur. Such protection would be too costly for such a rare event. Therefore, governmental and private institutions have agreed that a one-percent flood (1/100) is the most infrequent event to be protected against. A one-percent flood, formerly called a 100-year flood, is a flood that would be exceeded in severity only once every hundred years on average. Statistically, the chance of getting hit by a 100-year storm during a 30-year mortgage period is about 25 percent or one chance in four. The average house lasts about 70 years. **During that average useful lifetime, there is a 50 percent chance of a 100-year storm.** That's like flipping coins -- heads or tails. While low in any year, the cumulative risk for a building is quite high. The occurrence of a 100-year does not indicate that a similar storm will not occur for another 100 years. 100-year storms have been followed by equally severe storms the next year.

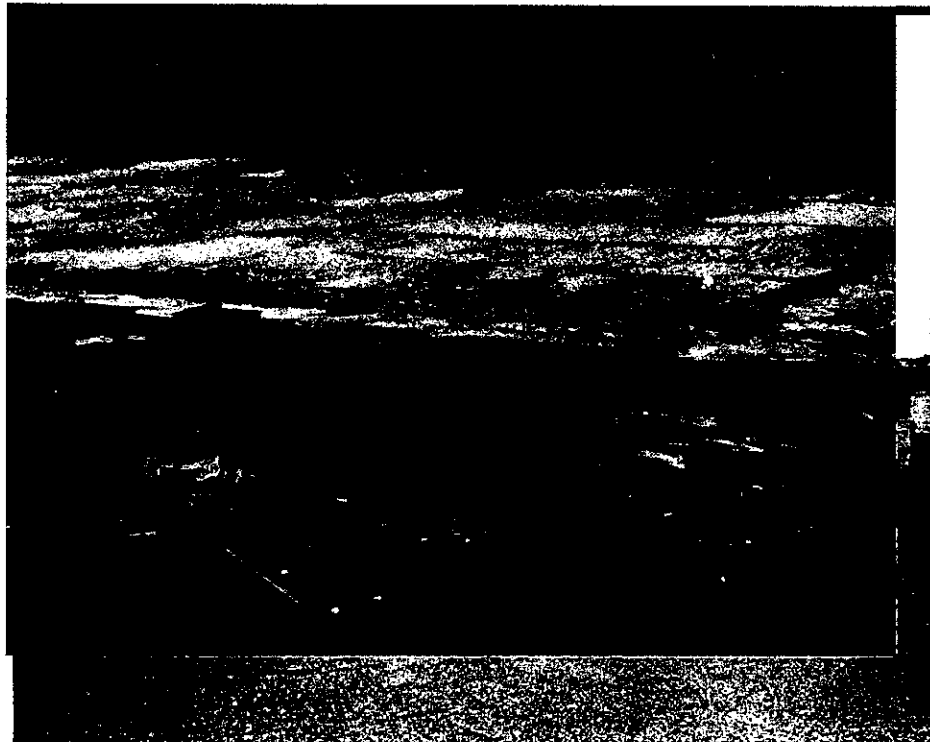
The Town received Flood Insurance Rate Maps (FIRM), effective September 20, 2006, resulting from a revised Flood Insurance Study. Implementations of those maps increased properties in our floodplain from 823 (previous study) to 1,482. This represents about 50% of all residential lots within the Town. The 1993 FIRM maps are overdue for their 5-year revision and the State of North Carolina is presently undertaking the update for FEMA as a Cooperating Technical State (CTS).

Repetitive Loss Areas

Based on an NFIP Repetitive Loss Correction Worksheet (AW-512) dated January 31, 2000, the Town of Southern Shores had one (1) repetitive loss property. That property has been recently demolished and a new 5 bedroom house was rebuilt on the site that is in compliance with current codes. A repetitive loss property is one for which two or more NFIP losses of at least \$1,000 each have been paid since 1978. Because repetitive flooding accounts for approximately 40% of all flood insurance claims payments, a Category B community (1-9 repetitive loss properties) may voluntarily submit a repetitive loss plan under the CRS program for credit under this activity.

Because this plan is prepared in accordance with CRS guidelines, FEMA has agreed that it will qualify as the Town's Repetitive Loss Plan needed for the CRS.

Figure 19. Photo of Kitty Hawk Pier, March 1962



Photograph by Aycock Brown, courtesy of
the Outer Banks History Center, Manteo,
NC

Figure 20. Photo of

floodwaters, March 1962



Photograph by Aycock Brown,
courtesy of the Outer Banks History Center,
Manteo, NC

Figure 21. Photo of flood damage, March 1962

Photograph by Aycock Brown, courtesy of the Outer Banks History Center, Manteo, NC

Flood Hazard Inventory

According to FEMA NFIP (5/02), the Town had 1,049 policies in force. The annual written premium is unknown for just Southern Shores because some properties from Duck and Martins Point continue to get included. In 1995 the Town had 496 policies in force within the town limits.

There are 2,900 properties within the corporate limits of Southern Shores. The total number of residences in Southern Shores is 2,186 (4/03) or 74% of available properties.

On the 1993 FIRM there are 210 properties located in Zone VE, of which 196 are developed (94%). In Zone AO, there are 461 properties, 396 are developed (86%). In Zone AE, there are 828 properties, 591 are developed (72%). Zone X (outside the mapped floodplain) contains 1,408 properties and 1,020 residences.

On the current FIRM there are 169 properties located in Zone VE, of which 151 are developed (89%). In all (9, 9.4 and 7) AE zones there are 1454 properties with 1169 developed (80%). Zone X (outside the mapped floodplain) contains 1259 properties and 1002 residences (80%).

Southern Shores:

Residential Properties By Flood Zone (FIRM revised April 2, 1993)

Flood Zone	Total # Properties	Total Improved	# Flood Policies	Policy: Houses
VE	210	196	106	54%
AO	461	396	234	59%
AE	828	591	328	56%
X	1,408	1,020	174	17%
Total:	2,900	2,203	842	-

Residential Properties By Flood Zone (FIRM revised September 20, 2006)

Flood Zone	Total # Properties	Total Improved	# Flood Policies	Policy: Houses
VE 14	4	4	No Data Available	"
VE 12	232	214	"	"
AE 9	537	455	"	"
AE 7	916	422	"	"
X	1,259	1,003	"	"
Total:	2,900	2,203	"	"

Table 12. Southern Shores Residential Properties By Flood Zone

In addition to the flood insurance policy penetration, an assessment of the vulnerability of each flood zone was conducted. Table 13, Table 14, and Table 15 illustrate the vulnerability of each flood zone.

For residential properties, the number of existing residential properties was multiplied by the average number of persons per household (2.3266) according to the 2000 Census. Also, the tax assessment for each property was included to calculate the potential value of properties located within the flood zone to determine a rough estimate of the potential property damage that may occur. The number of vacant lots in each flood zone was included in the assessment and was multiplied by the average number of persons per household to project how many people would potentially be impacted by a coastal storm event. Additionally, the number of projected residential buildings was multiplied by the average property value for the existing properties within that particular flood zone.

The same methodology was used for commercial properties. The linear feet of roads in each flood zone was also calculated and multiplied by \$12 per linear foot to determine the potential replacement cost if the roads in the flood zones were adversely impacted. A replacement value of \$6,300,000 was assigned to the school.

Properties were assigned to the respective flood zone according to the centroid, or center point, of the property. For example, if a property is located partially in the flood zone and partially outside the flood zone, the determination is made according to where the centroid of the property is located.

Hazard Area Location: VE Flood Zone - 1999 Flood Map

	Developed Land			Undeveloped Land		
	Number of People	Number of Buildings (from tax records)	Approximate Value (from tax records)	Number of People (if developed under existing policies)	Number of Buildings (if developed under existing policies)	Approximate Value (average current value times the number of buildings from previous columns)
Residential	347	148	\$16,051,400	21	9	\$976,095
Commercial		0	\$0		0	\$0
Industrial		0	\$0		0	\$0
Public Buildings and Critical Facilities			Replacement Value		0	\$0
Roads		10,500 ft	\$126,000		0	\$0
Total	347	148	\$16,177,400	21	9	\$976,095

Table 13. VE Flood Zone Area Vulnerability Assessment

Hazard Area Location: AO Flood Zone - 1999 Flood Map

	Developed Land			Undeveloped Land		
	Number of People	Number of Buildings (from tax records)	Approximate Value (from tax records)	Number of People (if developed under existing policies)	Number of Buildings (if developed under existing policies)	Approximate Value (average current value times the number of buildings from previous columns)
Residential	1,016	433	\$88,304,000	202	86	\$17,538,410
Commercial		0	\$0		0	\$0
Industrial		0	\$0		0	\$0
Public Buildings and Critical Facilities			Replacement Value		0	\$0
<i>East Fire Station</i>		1	\$208,200		0	\$0
<i>Roads</i>		60,500 ft	\$726,000		0	\$0
Total	1,016	434	\$934,200.00	202	86	\$17,538,410

Table 14. AO Flood Zone Area Vulnerability Assessment

Hazard Area Location: AE Flood Zone - 1999 Flood Map

	Developed Land			Undeveloped Land		
	Number of People	Number of Buildings (from tax records)	Approximate Value (from tax records)	Number of People (if developed under existing policies)	Number of Buildings (if developed under existing policies)	Approximate Value (average current value times the number of buildings from previous columns)
Residential	769	328	\$70,494,600	600	256	\$55,020,032
Commercial		11	\$3,120,900		0	\$0
Industrial		0	\$0		0	\$0
Public Buildings and Critical Facilities			Replacement Value		0	\$0
<i>Kitty Hawk Elementary School</i>		1	\$7,429,400		0	\$0
<i>Roads</i>		70,550 ft	\$846,600		0	\$0
<i>Water Tower</i>		1	\$30,000		0	\$0
<i>South Fire Station</i>		1	\$298,200		0	\$0
Other 3 Bridges, 1		4	\$3,400,000		0	\$0

Culvert						
Electric Transmission Lines			\$3,932,979			
Telephone Transmission Lines			\$2,180,235			
Total	769	346	\$18,117,414	600	256	\$55,020,032

Table 15. AE Flood Zone Area Vulnerability Assessment

Review of Possible Activities

It is important that the Town consider all possible ways to reduce flood losses and protect the natural areas. To ensure that the full range of alternatives was reviewed, the Committee used the list of strategies and tools recommended by the National Flood Insurance Program Community Rating System CRS Coordinators Manual (FEMA Publication FIA-15, January 1999), and modified it to meet the requirements of the Disaster Mitigation Act of 2000.

The CRS Coordinators Manual lists six strategies and numerous tools to prevent or reduce flood losses and to preserve and restore the natural resources and functions of floodplains. The Committee discussed each of these strategies in detail.

Policies and programs, including ones included in the list above were reviewed and evaluated according to effectiveness and cost. Those policies and programs that scored high on effectiveness and low on cost were given priority and were used to develop the Action Plan.

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
1. Preventive – keep flood problems from getting worse. They are usually administered by building, zoning, planning, and/or code enforcement offices.				
Zoning ordinance	Adopted May 4, 1979	High	Low	High because the zoning regulations restrict development, thereby putting less property at risk
Waterway Ordinance	(84-0037) Adopted April 3, 1984	High	Low	High because the maintaining canals clear of debris promotes drainage in the event of a flood
Flood Damage Prevention Ordinance	(2006-07-01) Adopted August 1, 2006	High	Low	High because the regulations require new construction to be built at or above BFE + 2' and the >50% rule for rebuilding and/or remodeling.
Dune Protection Ordinance	Adopted April 8, 1980	High	Low	High because dunes play a vital role in protecting property from storm surge damage
Coastal Area Management Act (CAMA)	(80-0017) Adopted April 8, 1980	High	Low	High because CAMA regulations protect property from natural hazards
2. Public Information Activities – advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains.				
Permitting	Town Code, Building Permits Adopted August 8,	High	Low	High because new development must adhere to Town

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
	1979			codes to receive a permit
Education Activities (ISO Community Rating System program Outreach brochure mailing)	N/A	Medium	Low	Medium because education activities do not always effectively reach the target audience
Floodplain Mapping (Subdivision Ordinance adopted 12/1/92 Flood Hazard area with an effective date of flood insurance rate map (FIRM))	Adopted December 1, 1992	High	Low	High because mapped areas give property owners an idea of flooding associated with different storm events
Real Estate Disclosure	N/A	Low	Low	High because although there is no federal or state requirement, disclosures would better inform potential property owners
Library – Dare County Library, Strategy Plan	N/A	Low	Low	Low because people do not take advantage of the library
Technical Assistance (provided as part of Permitting and Inspections services)	N/A	High	Medium	High because there are a number of local, state, and federal agencies
Base Flood Elevation Sentinels	To Be Determined	High	Low	High because the program would help educate citizens and visitors about water

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
				levels associated with different storm events
3. Property Protection – usually undertaken by property owners on a building-by-building or parcel basis.				
Building Elevation	Flood Damage Prevention Ordinance	High	Medium	High because the ordinance requires new construction to be built at or above BFE
Floodproofing	NC State Building Code Volume 1	Medium	Low	Medium because dry flood proof is permitted for commercial structures only and needs to be physically installed prior to the flood event
Insurance	National Flood Insurance Program	High	Low	High because well-insured structures can be reconstructed
Relocation	N/A	Medium	Medium	Medium because older structures are economically obsolete in many cases. Many are demolished due to age and condition by owners to make way for a new structure that will comply with the current code.
Acquisition	N/A	Low	High	Low because while

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
				acquisition would remove vulnerable structures from harm; few repetitive loss properties in Town
Retrofit	N/A	High	Medium	High because retrofitted structures meet wind resistant construction standards
4. Emergency Services – taken during a flood to minimize its impact. These measures are the responsibility of city or county emergency management staff and the owners of critical facilities.				
Flood warning	Dare County Emergency Operations Plan	High	Low	High because the warnings are typically posted on radio and television and reach much of the population
Flood response	Dare County Emergency Operations Plan	High	Low	High because the Town and the County effect rapid response
Emergency Operations Center	Dare County Emergency Operations Plan	High	Low	High because the Town has procedures for the operation of the center
Health and safety maintenance	Dare County Emergency Operations Plan	High	Low	High because health and safety are important to the Town, the evacuation routes are moderately protected from hazards
5. Natural Resource Protection – preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are usually implemented by parks or recreation.				

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
Permitting	Town Code, Building Permits Adopted August 8, 1979	High	Low	High because new development must adhere to Town codes to receive a permit
Coastal Barrier Protection – CAMA (residential)	(80-0017) Adopted April 8, 1980	Medium	Low	Medium because although these measures can protect property against erosion, they are expensive
Erosion and Sedimentation Control (commercial, > 1 acre)	NCGS 113A-60	Low	Medium	Low because sandy soils provide good drainage in most storm events during construction with little runoff. Sand fencing installed along dunes per CAMA requirements good for dune stabilization
Private Property Owners Association	Document reference, recorded covenants	High	Low	High because common areas owned by the property owners association is maintained as open space in perpetuity
Wetlands	Section 404	Medium	Low	Medium because wetlands serve as a flood control measure and provide a natural function of the floodplain

<i>Policies & Programs</i>	<i>Document Reference</i>	<i>Effectiveness (High, Medium, Low)</i>	<i>Cost (High, Medium, Low)</i>	<i>Rationale For Effectiveness</i>
6. Structural Projects – keep flood waters away from an area with a levee, reservoir, or other flood control measure. They are designed by engineers and managed or maintained by public works.				
Stormwater Management Regulations	Title 15A NCAC 2H. 1000	High	Low	High because the regulations require new developments to provide for stormwater
Channel Modifications	To be determined	Low	High	Low because channelization can significantly increase runoff. Modification of existing waterway channels, i.e. interconnections, may require property condemnation and/or easements.
Beach Nourishment	N/A	Low	High	Low because of low erosion rate in Southern Shores
Right-of-way swales	N/A	High	Low	High because, without right-of-way swales, runoff goes unchecked into the waterways

Table 16. Evaluation of Policies and Programs

Flooding Policy

When the Town of Southern Shores encounters a hurricane, thunderstorm, or tornado, it will also experience excessive water and/or flooding. To limit the damage in terms of property, personal injuries and loss of life, the Town has the following policies and programs in place:

FEMA NFIP Flood Insurance Rate Map (FIRM)

The Town of Southern Shores maintains the current paper FIRM in the Town Hall Code Enforcement offices. The Town also has generated both a paper and digital map that overlays the Flood Zone boundaries on the platted lots to educate and regulate landowners planning to improve residential and commercial property. The digital map showing various flood zones is available on the Town's web site at www.southernshores.org.

Flood Damage Prevention Code

The Town has in place a Flood Damage Prevention Code which sets forth standards as they relate to building and development near and within flood prone areas.

ISO's Community Rating System (CRS) Program

The Town voluntarily participates in ISO's Community Rating System (CRS) Program and has adopted some Flood Hazard Mitigation standards such as a 2' freeboard requirement that exceeds the Federal Minimum requirements.

CAMA 30' Public Trust waters Buffer Rules

Requires that no house, building or other non-water dependent structure be built within 30 feet of any Public Trust waterway.

Maintenance of Waterways and Canals

The Southern Shores Civic Assoc. Boat Club conducts semi-annual surveys of the canal system for debris and growth. This maintenance program involves controlling vegetative growth in order to keep these creeks, streams and waterways free of obstructions to reduce the likelihood that the banks of these channels will overflow causing flooding and its related damage.

Gaps, Shortfalls or Conflicts with Flooding Policy

Owners of unimproved property adjacent to canals have not always maintained shoreline vegetation per the Waterways ordinance requirement. Recent experience during high wind and flooding events suggests that significant trees are lost when the shoreline is undermined by erosion of the banks. The Southern Shores Civic Assoc. Boat Club encourages canal front owners to bulkhead property. The Town has not mandated bulkheading of shoreline. NFIP flood maps have been updated September 20, 2006.

Technical & Fiscal Capabilities

The Town has the in-house technical expertise in the Code Enforcement Department to enforce and carry out the policies, programs and ordinances which are under the authority of the Town as they deal with mitigating damage related to the high winds associated with hurricanes, thunderstorms, and tornadoes.

ANNEX 7



Town of Southern Shores

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Resolution 2009-10-13

Resolution of the Town of Southern Shores Council Requesting Action By the Dare County Board of Commissioners to Merge The Hazard Mitigation Plan for the Town of Southern Shores with the Dare County Hazard Mitigation Plan

WHEREAS, on October 30, 2000, the President of the United States signed into law the Disaster Mitigation Act of 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 to reinforce the importance of pre-disaster mitigation planning to help reduce disaster losses; and

WHEREAS, North Carolina Senate Bill 300 requires all local governments to have an approved Hazard Mitigation Plan in order to receive state public assistance funds (effective for state-declared disasters after November 1, 2004; and

WHEREAS, the Town of Southern Shores Hazard Mitigation Plan was approved on February 15, 2005 by the Southern Shores Town Council and subsequently approved by the Federal Emergency Management Agency (FEMA) and the North Carolina Division of Emergency Management (NCEM) and revised September 23, 2008; and

WHEREAS, the Town of Southern Shores has to update the Town of Southern Shores Hazard Mitigation Plan as required every five (5) years by FEMA and NCEM; and

WHEREAS, the Town of Southern Shores, in accordance with guidance provided by FEMA, NCEM, and the County of Dare, now desires to include said Plan with the County of Dare as part of their Hazard Mitigation Plan update which is currently in process.

NOW, THEREFORE, BE IT RESOLVED that the Town of Southern Shores Council hereby requests that the Dare County Board of Commissioners incorporate the Town of Southern Shores Hazard Mitigation Plan as part of a Multi-Jurisdictional Hazard Mitigation Plan Update for Dare County.

Adopted this 11th day of November 2009

ATTEST: SEAL

Carrie Gordin, Town Clerk

Don Smith, Mayor

GLOSSARY

Base Flood: A term used in the National Flood Insurance Program to indicate the minimum size flood to be used by a community as a basis for its floodplain management regulations; presently required by regulation to be that flood which has a one-percent chance of being equaled or exceeded in any given year. Also known as a 100-year flood or one-percent chance flood.

Base Flood Elevation (BFE): The elevation for which there is a one-percent chance in any given year that flood levels will equal or exceed it. The BFE is generally based on statistical analysis of stream flow records for the watershed and rainfall and runoff characteristics in the general region of the watershed, and application of hydraulic backwater models.

Base Floodplain: The floodplain that would be inundated by a one-percent chance (100-year) flood.

Building Code: The regulations adopted by a local governing body setting forth standards for the construction, addition, modification, and repair of buildings and other structures for the purpose of protecting the health, safety, and general welfare of the public.

Building: A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Community: Any state or area or political subdivision thereof, or any Indian tribe or authorized tribal organization which has the authority to adopt and enforce regulations for the areas within its jurisdiction.

Community Rating System (CRS): Administered by FEMA, the Community Rating System provides flood insurance discounts for residents in NFIP communities that undertake floodplain mitigation activities above the minimum NFIP standards.

Critical Facility: Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, hospitals, and lifeline infrastructure such as water and sewer treatment facilities, power generation stations, communication and transportation networks. Essential facilities are elements that are important to ensure a full recovery of a community following a hazard event. These would include: government functions, major employers, banks, schools, and certain commercial establishments, such as grocery stores, hardware stores, and gas stations.

Design Flood: Commonly used to mean the magnitude of flood used for design and operation of flood control structures or other protective measures. It is sometimes used to denote the magnitude of flood used in floodplain regulation.

Disaster/Emergency: Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the "Stafford Act"), the Governor may request that the President declare a major disaster or emergency when state and local resources are insufficient to recover from the impact of the event. Following a Presidential declaration, the Federal Emergency Management Agency designated the types of assistance to be made available under the Stafford Act. This may include individual assistance, public assistance, and/or hazard mitigation assistance. Depending upon the situation, other Federal disaster relief programs may be activated as well.

A major disaster is defined as any natural catastrophe, or, regardless of cause, any fire, flood, or explosion that causes damage of sufficient severity and magnitude to warrant assistance supplementing state, local, and disaster relief organization efforts to alleviate damage, loss, hardship, or suffering.

An emergency is defined as any occasion or instance for which federal assistance is needed to supplement state and local efforts to save lives and protect property and public health and safety, or to lessen or avert the threat of a catastrophe.

Enabling Statute: A State law that transfers some of the police power residing in the State to localities within it for the purpose of zoning, subdivision, regulations, building codes, and the like.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents.

Federal Emergency Management Agency (FEMA): An independent agency of the federal government, reporting to the President. FEMA's mission is to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery.

Flood Frequency: A statistical expression of the average time period between floods equaling or exceeding a given magnitude. For example, a 100-year flood has a magnitude expected to be equaled or exceeded on the average of once every hundred years; such a flood has a one-percent chance of being equaled or exceeded in any given year. Often used interchangeably with 'recurrence interval.'

Flash Flood: A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flows.

Flood or Flooding: Temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source. The rise in water may be caused by excessive rainfall, snowmelt, natural stream blockages, wind storms over a lake, or any combination of such conditions.

Flood Control: Keeping flood waters away from specific developments or populated areas by the construction of flood storage reservoirs, channel alterations, dikes and levees, bypass channels, or other engineering works.

Flood Depth: Height of the floodwater surface above the ground surface.

Flood Insurance Rate Maps (FIRMs): The official map of a community prepared by FEMA, showing base flood elevations along with the special hazard areas and the risk zones.

Flood Insurance Study (FIS): A study that provides an examination, evaluation, and determination of flood hazards, and if appropriate, corresponding water surface elevations in a community or communities. Also contains information on local flood history, local flood problems, and other flood studies.

Floodplain: Any normally dry land area that is susceptible to being inundated by water from any natural source. This area is usually low land adjacent to a river, stream, watercourse, ocean or lake.

Floodplain Management: The operation of a program of corrective and preventive measures for reducing flood damage, including but not limited to flood control projects, floodplain land use regulations, flood proofing buildings, and emergency preparedness plans.

Flood proofing: Any combination of structural and nonstructural additions, changes, or adjustments to properties and structures which reduce or eliminate flood damage to lands, water and sanitary facilities, structures, and contents of buildings.

Floodway: The channel of a watercourse and those portions of the adjoining floodplain required to provide for a passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (one foot in most areas).

Freeboard: A factor of safety expressed in feet above a design flood level for flood protective or control works. Freeboard is intended to allow for all of the uncertainties in analysis, design and construction, which cannot be fully or readily considered in an analytical fashion.

Geographic Information System (GIS): A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Hazard: A source of potential danger or adverse condition. Hazards include such naturally occurring events as floods, earthquakes, tornadoes, coastal storms, landslides, wildfires, and droughts that strike populated areas.

Hazard Event: A specific occurrence of a particular type of hazard.

Infrastructure: Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams.

Intensity: A measure of the strength of a hazard event. The intensity (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigation: Any action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of hazards. Some examples include elevating houses above base flood levels, acquiring land in hazard areas, and zoning land in floodplains for parkland or low density use.

Mitigation Plan: A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the community and includes policy and implementation procedures designed to minimize present and future vulnerability to hazards.

National Flood Insurance Program (NFIP): Administered by the Federal Insurance Administration, the National Flood Insurance Program makes federally subsidized flood insurance available to property owners in communities that participate in the program. Participating communities must adopt and enforce floodplain management ordinances that meet the criteria established by FEMA.

North Carolina Coastal Area Management Act (CAMA): Enacted by the North Carolina General Assembly in 1974, the act created a new regulatory and planning framework for managing the resources and land use in the twenty counties included in the designated coastal zone. CAMA created the Coastal Resources Commission, establishing a permitting system for activities in areas of environmental concern, and mandated local coastal planning.

Repetitive Loss Plan: Under the Community Rating System (CRS), a Category C repetitive loss community has 10 or more repetitive loss properties. Because repetitive flooding accounts for approximately 33% of all flood insurance losses, Category C repetitive loss communities must prepare floodplain management plans for their repetitive loss areas. The CRS no longer provides separate credit for "repetitive loss plans." A Category C community can either prepare a floodplain management plan for all of its known flood problem areas, or it can prepare one that covers just its repetitive loss areas.

Repetitive Loss Property: Under the Community Rating System (CRS), a repetitive loss property is one for which two or more flood insurance claims of at least \$1,000 each have been paid within any 10-year period since 1978.

Replacement Value: The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type, and quality.

Riparian Buffer: An area contiguous to one or both sides of a watercourse that is maintained in a natural vegetative state.

Riverine: Of or produced by a river.

Runoff: That portion of precipitation, which is not intercepted by vegetation, absorbed by the land surface or evaporated, and thus flows overland into a depression, stream, lake or ocean (runoff call "immediate subsurface runoff also takes place in the upper layers of the soil).

SLOSH (Sea, Lake, and Overland Surges form Hurricanes) Maps: A computer simulation model developed for the National Weather Service used to predict the still-water super-elevation (i.e., the storm surge) of storm waters caused by the drop in barometric pressure, wind speed, forward speed of the storm, storm track, near shore bathymetry, shoreline configuration, and near shore topography. The SLOSH model is essential for developing hurricane evacuation plans in exposed coastal areas. Output from a SLOSH model has been used to create hurricane storm surge inundation areas for GIS and mapping.

Special Flood Hazard Areas: Areas in a community that have been identified as susceptible to a one-percent or greater chance of flooding in any given year. A one-percent-probability flood is also known as the 100-year flood or the base flood. Special Flood Hazard Areas are usually designated on the Flood Hazard Boundary Map (FHBM) as Zone A. After detailed evaluation of local flooding characteristics, the Flood Insurance Rate Map (FIRM) will refine this categorization in Zones A, AE, AH, AO, A1-30, VE and V 1-30,

Structure: Something constructed (See also Building)

Subdivision Regulations: Ordinances or regulations governing the subdivision of land with respect to such things as adequacy and suitability of building sites, utilities and public facilities.

Vulnerability: The extent to which people will experience harm and property will be damaged from a hazard.

Wetlands: Areas that are inundated or saturated at a frequency and for a duration sufficient to support a prevalence of vegetative or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction.

Zoning Ordinance: An ordinance under the local government's police power, which divides an area into districts and, within each district, regulates the use of land and buildings, height and bulk of buildings and other structures, and the density of population.